THE

AMERICAN REVIEW OF TUBERCULOSIS
ABSTRACTS OF TUBERCULOSIS

VOLUME XXXV MAY, 1937 ABST. NO. 3

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Avian Tubercle Bacilli in Guinea Pigs.—The guinea pig has a relatively high resistance to tubercle bacilli of avian origin, and it is exceptional that inoculation is followed by well-marked or generalized infection, such as usually occurs when bovine or human bacilli are introduced. Having previously observed that occasionally isolated avian tubercle bacilli could be isolated from the tissues of guinea pigs showing no morbid changes, the recoverability of these organisms from a large series of experimentally infected animals was determined. Approximately 40 adult guinea pigs were inoculated subcutaneously with 0.5 cc. of a suspension of virulent avian tubercle bacilli. Animals were killed after varying periods ranging from one to seven days and from one to ten weeks, the spleens were removed, and the entire organs emulsified for culture. Weak oxalic acid was used for treating the emulsion to eliminate possible contaminants. The sediment obtained after centrifugation was planted on glycerine-egg-yolk-agar medium, and the tubes incubated for 100 days unless positive cultures were obtained earlier. The earliest positive culture was from an animal killed at three days. In general, the avian tubercle bacillus was obtained from 8 of the 20 guinea pigs examined at necropsy up to and including 21 days after receiving the infective inoculum. Of the 14 animals examined at 28 to 70 days, 13 yielded the specific microorganism. Macroscopic lesions of a tuberculous character were present in only one of the 44 animals examined. These results show that the organism of avian tubercle bacilli may be recovered from infected guinea pigs, although gross lesions of tuberculosis are usually absent. It is important to keep this in mind when examining guinea pigs inoculated with emulsions of tissues from cattle. Cultures of the spleen of such guinea pigs may be necessary to detect the presence of avian tubercle bacilli.—*The Recoverability of Mycobacterium Tuberculosis Avium from Experimentally Infected Guinea Pigs, W. H. Feldman, J. Infect. Dis., July–August, 1936, lix, 1.*—(*J. S. W.*)

Avian Tubercle Bacilli in Swine.—Five million hogs, slaughtered in 1934 under the supervision of Federal Meat Inspectors, were reported as possessing lesions of tuberculosis. As tuberculosis in swine is usually localized and slight, only 40,000 of these animals were condemned as unfit for food. In the rest the affected or diseased tissue was removed and the carcass passed as suitable for human consumption. The availability of such an abundance of material suggested the desirability of determining by careful methods whether the tissues of hog carcasses, which possess lesions of tuberculosis of insufficient degree to cause condemnation or sterilization, might still contain tubercle bacilli after all grossly visible evidence of the disease had been removed. Lymph nodes from 101 swine were obtained, only one from each carcass. After surface sterilization, the node was ground and emulsified and a portion of the emulsion treated with 5 per cent oxalic acid and finally seeded on glycerine-egg-yolk-agar. In those in-

stances in which cultures of acid-fast bacilli were obtained, appropriate tests were done to determine the type of bacillus present in each. Of the 101 specimens, tubercle bacilli were obtained from four. Studies of pathogenicity revealed all strains to be *Mycobacterium tuberculosis avium.* It is doubtful whether the bacilli of avian tuberculosis in carcasses of swine from which slight or localized tuberculous lesions have been removed constitute a hazard to human beings consuming such meat. Avian tuberculosis in human beings is rare, and the heat necessary to cook meat is usually sufficient to kill any tubercle bacilli that might be present. Nevertheless, this study emphasizes anew the importance of the problem of avian tuberculosis, and should indicate that virulent tubercle bacilli may still be present in the carcasses of hogs even though all visible lesions of tuberculosis have been removed.—*The Recovery of Virulent Tubercle Bacilli from the Tissues of Swine Intended for Food, W. H. Feldman, J. Infect. Dis., July–August, 1936, lix, 43.*—(*J. S. W.*)

Avian Tubercle Bacilli and Guinea Pigs.—By serological studies it has been shown that avian tubercle bacilli, indistinguishable by cultural characteristics, are in reality composed of two distinct types, differentiated by a specific type-antigen. Tubercle bacilli of avian type were isolated from various kinds of birds and experimental guinea pigs with spontaneous tuberculosis, and were classified as to type. Standard suspensions of the bacilli were set up with antisera of each type, haemolytic serum to which red blood cells were added and the haemolysis noted. By this method it was found that infections with avian tubercle bacilli are caused almost exclusively by the two types of avian bacilli serologically distinguishable. The incidence of infection with the two types is almost equal. Not only are birds susceptible to avian tuberculosis but also experimental guinea pigs are accidently contaminated.—*La fréquence des deux types du bacille de la tuberculose aviaire dans l'infection naturelle des oiseaux et chez les cobayes d'expériences, W. Schaeffer, Compt. Rend. Soc. Biol., February 29, 1936, cxxi, 815.*—(*M. T. W.*)

Pathogenicity of Avian Tubercle Bacilli for Guinea Pigs.—Intravenous inoculations of avian tubercle bacilli, varying from 0.01 to 1.0 mgm., were made into guinea pigs. The subcutaneous inoculation of avian tubercle bacilli produces localized lesions only in the guinea pig. Intravenous inoculations, on the other hand, produce generalized infections. Bacillaemia is present up to the eighth day following injections of 0.01 mgm. When larger doses are inoculated, bacillaemia persists to the terminal period. This haematogenous infection is identical to the Yersin type described in the rabbit, with hypertrophied spleen and liver, pulmonary lesions and lymphatic enlargement. But the Villemin type of nodular lesion is not observed. If the dosage is sufficient (1 mgm.) and the strain very virulent, intravenous inoculations of avian bacilli produce fatal infections in guinea pigs in about three weeks.—*Infection des cobayes par le bacille tuberculeux aviare inoculé par voie veineuse, J. Bretey & R. Laporte, Compt. Rend. Soc. Biol., October 19, 1935, cxx, 316.*—(*M. T. W.*)

Virulence of Avian Tubercle Bacilli for Chickens and Rabbits.—From the time of their isolation tubercle bacilli of avian origin are composed exclusively of variety S. Twelve strains were isolated from tuberculous chickens, and studied to determine their virulence and the most frequent localizing lesions observed in chickens and rabbits inoculated intravenously. Inoculations of large doses of bacilli produced apparently identical types of lesions in both animals. The infection is a rapid, acute, toxic septicaemia, the animal dying between fourteen and twenty-one days. This septicaemia is characterized by a markedly hypertrophied liver and spleen and absence of gross nodular lesions. A subacute infection produced by the inoculation of a small dose killed the chicken and rabbit between one and three months. The chicken has a somewhat hypertrophied liver and spleen riddled with small nodules. The rabbit on the other hand, shows at autopsy generalized miliary tuberculosis. In this form a differential diagnosis between avian and bovine tuberculosis is most difficult. In general, however, recently isolated bovine tubercle bacilli produce more marked pulmonary involvement. Still another type of inoculation avian tuberculosis is produced by intravenous doses of 0.000,01 to 0.000,000,1 mgm. bacilli, which result in a chronic type of tuberculosis, animals dying in from four to seven months. In the rabbit this chronic avian tuberculosis is characterized by the constant presence of changes in the spongy tissue of the short bones and on the epiphyses of the long bones. Polyarthritis frequently occurs. In the chicken this type of inoculation tuberculosis corresponds to natural infection in birds.—*Degré de virulence des souches aviaires (variété S) récemment isolées et formes anatomo-cliniques de la tuberculose expérimentale provoquée, par voie veineuse, chez la poule et le lapin, A. Saenz,*

Compt. Rend. Soc. Biol., May 23, 1936, cxxii, 362.—(M. T. W.)

Invasiveness, Virulence and Resistance.—The inoculation of a culture of *Staphylococcus aureus*, or aleuronat, or turpentine, into a skin area into which virulent type-III pneumococci have been injected is accompanied by an increase in the survival time of rabbits. The increase in resistance thus manifested is due to a delay in the spread of the pneumococci from the site of their inoculation, and this is referable in turn to early mechanical obstruction by thrombosed lymphatics and coagulated plasma in the inflamed area. The presence of such a barrier in the experimental animals has been correlated both with the inability of a dye to diffuse readily into the regional lymphatics from the site of inflammation and by studies on the presence of pneumococci from the blood-stream. The observations indicate that the rapidity of invasion of a microorganism, as modified by the local inflammatory reaction, is a significant factor in determining the resistance or immunity of the host, but induced alterations in the rate of dissemination may leave the virulence of the bacteria essentially unaffected.—*Studies in Inflammation. XI. Invasiveness and Virulence in Relation to Resistance, V. Menkin, J. Infec. Dis., January–February, 1936, lviii, 81.—(J. S. W.)*

Factors of Resistance to Tuberculosis.—Age and sex come under the general head of "inherent" or of "constitutional" factors, the real nature and influence of which is amply demonstrated by animal experiment. Animals such as the guinea pig and cat respond very differently to the introduction of minute doses of tubercle bacilli of comparable size. They grow readily in the guinea pig; not at all in the cat. The explanation lies, not in any rapid destructive action on the part of the cat's fighting cells, but either in some inhibitory action of the cat's fluid juices or in an environment unfavorable to bacillary nutrition, whereas in the guinea pig, dispite an acute inflammatory outpouring of cells, the bacilli progressively multiply. Significant, if less marked, differences occur in particular animal species, as Lewis and Wright showed in guinea pigs, and Lurie, of the Phipps Institute, is at present finding in rabbits. Transferrence of these observations to the human field leads into one of the most strongly contested fields of epidemiology, as there are many and complex factors involved. The range of variation in racial resistance in man appears to be narrowing. The tuberculosis of Negroes, Polynesians, Eskimos and others who formerly showed astounding mortalities, seems to be to-day less acute. A particularly interesting case is that of the Indians of the Canadian plains, who, about 1880, were confined to reservations, with close-set homes and overcrowding. Under such conditions tuberculosis soon reached epidemic proportions, the rate for the Fort Qu'Appelle Valley in 1886 being 9,000 deaths per year per 100,000 living persons. But, within less than a decade a marked drop occurred, followed by a slower decline. The initial drop could scarcely have been due to improved environmental factors, but was probably due to elimination of the more highly susceptible stocks. In fact, a few naturally resistant, and a few very susceptible families, were discovered. From the records obtainable among various races, it seems that an adjustment between man and the bacillus has come about with elimination, more or less rapid, of the more susceptible stock, the white race having advanced the farthest; yet it too retains certain more susceptible elements, to which may be ascribed some observed variations. Although our present program toward reducing the spread of infection is in another direction than that of survival of the fittest, from the practical standpoint it can scarcely be other than beneficial. The postponement of primary infection to adult years renders it no less benign and if some physiologically susceptible stock is thus preserved we may look to further advances in our knowledge to deal with this.—*Present Concepts of Tuberculous Infection and Disease: Clinical and Pathological Consideration, E. R. Long, Tubercle, American Section, January, 1936, xvii, 166.—(A. P.)*

Acquired Resistance to Tuberculosis.—Immunity in tuberculosis is doubtless the result of many different factors, such as native resistance, acquired resistance, the amount of infection, and the nutritional state of the infected person. In the present paper evidence in favor of the assumption that a person does acquire some resistance in the course of a primary infection is presented. Ranke, in his classification of tuberculosis, assumed that there are three stages of the disease: (1) the primary focus, (2) the spreading of the bacilli, and (3) tertiary phthisis of an organ or of an organ-system. Recovery from stages 1 and 2 may result, but any reinfection, whether endogenous or exogenous, leads to stage 3, isolated chronic disease of an organ or an organ-system. Essential to the classification is the concept of a "blockade," which, developing in the course of a primary infection, localizes all subsequent lesions. This blockade may be

either lymphatic or haematic. To test these concepts, the findings in 81 cases of active tuberculosis, in which autopsies were performed, are reported. The gross and microscopic findings were tabulated especially with regard to the type of tuberculous disease and the efficiency of the blockade. There were 8 instances of primary infection and 75 of reinfection, two of 73 patients having both pulmonary and extrapulmonary lesions. Lymphatic blockade is assumed to be effective when the organ shows gross tuberculosis, but the lymph nodes draining it show no fresh tuberculous lesions grossly. Microscopically, a few isolated conglomerate tubercles or a few isolated miliary patches of necrosis may be seen. Breakdown of the lymphatic blockade occurs when these lymph nodes show conglomerate tubercle or necrosis grossly and microscopically. Breakdown of the blockade may also result with the production of massive caseation of the lymph nodes. These nodes show the picture seen in primary infection. Tuberculosis with haematogenous blockade includes all cases of gross tuberculosis of an organ or of an organ-system in which no evidence of fresh disease is seen in other organs in the gross, which disease might be interpreted as of haematogenous origin. Breakdown of the haematogenous blockade results when sporadic seeding occurs. Serious breakdown results in a diffuse seeding of any or all organs reached by the haematogenous route —miliary tuberculosis. In all 8 cases of primary tuberculosis there was massive necrosis of the lymph nodes; hence no lymphatic blockade. The involvement of the lymph nodes must be considered as an almost invariable component of a primary tuberculous infection. Of the 73 cases of reinfection, on the other hand, there was lymphatic blockade in 45 and massive necrosis typical of the nodes in primary infection in only 16. In the remaining 14 cases gross conglomerate tubercles were present. These figures do not give an accurate picture of the differences between the two groups, for massive necrosis of any lymph node in the body placed the case in the lymphatic-break group even though all other nodes were essentially free from gross tuberculosis. In general, reinfection is associated with a relatively efficient lymphatic blockade. In principle, the results of the investigation of the haematic blockade are similar. In 49 of the cases of reinfection there was a blockade of dissemination by way of the blood-stream, whereas in only 19 was true miliary tuberculosis present. In six of the 8 cases of primary infection true miliary tuberculosis was evident. This is an expression of the well-known fact that the patient who has a fatal primary tuberculous infection usually dies, not because of a pulmonary or intestinal lesion, but as a result of haematogenous dissemination from that point. The Negro patients in the series were a factor definitely tending to decrease the number of cases of lymphatic and haematic blockade. Although 73 per cent of the white patients showed lymphatic block, only 44 per cent of the Negroes were represented in this group. Also, 70 per cent of the white patients showed haematic block and only one-half of the Negroes. In chronic pulmonary disease the blockade is singularly efficient, for in only two of the cases reported as such was there associated pulmonary and extrapulmonary disease. The presence of infection by continuity does not controvert this rule. These results must be interpreted as a manifestation of resistance. The condition of the lung in cases of chronic pulmonary tuberculosis apparently contradicts this, since the organ is often completely destroyed. The dilemma is resolved, however, if immunity in tuberculosis is considered to be of a lesser degree and probably of an entirely different character from that of such diseases as measles and smallpox. The degree of resistance is not sufficient to prevent the development of clinical disease in certain organs whose preëxisting channels of communication render the disease easily diffusible. The forces of resistance do tend, however, to prevent the spread beyond the organ attacked. Immunity in tuberculosis, therefore, results largely in a localization of the disease, certainly as much a sign of resistance as in the pyogenic infections, in which the development of an abscess demonstrates the ability of the body to localize the infection and the development of septicaemia demonstrates an inability to do so. Animal experimentation has led a host of workers to acknowledge the existence of acquired resistance. It is difficult to interpret the Koch-Roemer experiment in any other fashion. There is no necessity of assuming that a permanent lesion or a liquefaction of tissue must result from the Koch phenomenon. It is probable that the clinical cases of reinfection tuberculosis represent only those cases in which resistance has failed. The clinician cannot recognize the many cases in which reinfection, like the majority of primary infections, develops and comes to a quiescent stage without the manifestation of any clinical signs or symptoms. The pathologist observes evidence of "healed" reinfection almost as often as he does the results of primary infection. It is frequently, but erroneously, assumed that pneumonic infiltration and especially caseation are the result of allergy. The primary focus, however, the earliest lesion in the body and one which is

forming at a time when sensitivity to tuberculin (allergy) has not yet developed, is the result of pneumonia and these pneumonic lesions may contain innumerable tubercle bacilli. The bacteria multiply apparently without hindrance in this early stage of the disease. In contrast, in cases of reinfection the demonstration of tubercle bacilli in the affected tissue is usually a tedious process. It would seem that reinfecting organisms are largely destroyed in the immune animal. Most observers are convinced that acquired resistance to tuberculosis exists. For man there are as yet no data concerning the relative importance of acquired as contrasted with native resistance.—*Acquired Resistance to Tuberculosis, with Investigations into the Validity of Ranke's Classification, H. S. Reichle & M. Gallavan, Arch. Path., June, 1936, xxi, 797.*—(*J. S. W.*)

Mechanism of Immunity in Tuberculosis.—There is still wide divergence of opinion as to the mechanism of immunity in tuberculosis. Whether the accelerated inflammatory response incident on reinfection plays a part has recently been doubted. The rôle of humoral substances has not been demonstrated; hence immunity in tuberculosis is generally considered as cellular in nature. It has been shown that immunity to intravenous reinfection depends upon the increased capacity of the mononuclear phagocytes to digest bacilli. Intravenous inoculation, however, does not correspond with natural infection. It was decided, therefore, to study the host-parasite relationships when the bacilli were introduced into the body in a localized area. For this procedure tubercle bacilli were incorporated in melted agar and injected subcutaneously. Virulent bovine tubercle bacilli, suspended in india-ink or trypan-blue dilutions (1 per cent) were added to melted and partly cooled agar, and 5 cc. of the mixture was injected subcutaneously into each of the normal and immunized rabbits of a given series. The ink and the trypan-blue served not only as a guide to the distribution of the bacilli within the highly viscous melted agar, but also for the purpose of indicating the dissemination of these materials to the tributary lymph nodes. Simultaneously, these rabbits received subcutaneously on the opposite side a mixture of melted agar and dye without bacilli. The number of colonies cultured from known amounts of a given tissue was correlated with the histological changes in the immediately adjacent tissue. Two types of rabbits were used, one immunized with *BCG* and the other with *BCG* followed by virulent bovine tubercle bacilli. The host-parasite relationships in these two groups were compared to those in a group of normal rabbits simultaneously inoculated with the same agar-tubercle-bacillus suspension. In both groups a marked if not complete inhibition of growth of bacilli was apparent in the vaccinated animals as compared with unhindered and tremendous accumulation of the bacilli in the normal animals. The mechanism of immunity as revealed by these experiments may be summarized as follows: The inflammatory reaction is more intense in the vaccinated than in the normal animal, which leads to a greater outpouring of cells and fluid into and about the agar focus containing the bacilli of reinfection. There is a larger and denser barrier of fibrin about the agar focus as a whole and the individual agar islands of the vaccinated animals. The greater agglutination of particulate matter, as shown by the carbon particles in the agar focus, would also tend to immobilize the tubercle bacilli. More important factors are those which tend to inhibit the multiplication and enhance the destruction of the bacilli. An extracellular factor is present, which inhibits the multiplication of the bacilli in the agar islands away from the cells in the vaccinated animal, whereas in the normal creature the multiplication of the bacilli in these regions is unhindered. Furthermore, there is a greater and more rapid mobilization of the mononuclears which engulf and destroy the tubercle bacilli in the vaccinated animal. Thus both extracellular and intracellular factors operate to inhibit the growth and destroy the bacilli of reinfection. On the other hand, in the normal animal the impotent polymorphonuclears persist and the mononuclears arrive late and their capacity to destroy tubercle bacilli is markedly less than after vaccination. With large doses, on reinfection, the increased lymph-flow resulting from the intensified inflammation in the immunized animal brings about a more rapid dissemination of the bacilli to the draining lymph nodes than in the normal animal. However, the invading bacilli that reach the draining lymph nodes of the immunized animal are retarded in multiplication or destroyed by the mononuclear phagocytes. In fact the most significant factor in immunity is the increased capacity of these cells to destroy tubercle bacilli. The greater immunity afforded by a virulent primary infection expresses itself as a quantitative increase of the same factors which operate in the mechanism of resistance of animals immunized with a less virulent infection. These observations permit a definite view on the question of the rôle of allergy in tuberculosis. With small doses on reinfection, such as those from exogenous sources

in man under natural conditions, brings about the fixation of the bacilli at the portal of entry and the inhibition of their multiplication as described above. With larger doses, however, such as can be derived only from endogenous spread, the heightened inflammation of reinfection will bring about a more rapid dissemination of the bacilli, if man reacts as a rabbit does; but even in such cases as soon as the invading bacilli reach a new territory, the forces of immunity, both humoral and cellular, tend to fix and destroy them.—*On the Mechanism of Immunity in Tuberculosis. The Host-Parasite Relationship under the Conditions of a Localized Agar Focus of Infection and the Generalization of the Disease in Normal and Immunized Rabbits, M. B. Lurie, J. Exper. Med., 1936, lxiii, 923.*—(*J. S. W.*)

Specific Immunization of Rabbits against Tuberculosis.—It has been shown that rabbits can be immunized by six half-subcutaneous, half-intravenous injections of avian tubercle bacilli or heat-killed atypical S variants to a subsequent large intravenous inoculation of living bacilli always fatal to control animals. There seems to exist in the rabbit a certain power of cross immunization. However this power of extreme sensitization characterizing the atypical strains may produce death by shock in immunized animals following a large dose of the same organism. The clinical course of animals thus immunized was followed closely. Thirty-four days after the last immunizing dose of killed bacilli, the animals received an intravenous dose of 1 mgm. of living bacilli, S variant. The immunizing doses produced a slight rise in lymphocytes. The experimental dose of living bacilli in the immunized animal produced an immediate marked rise of neutrophiles in the animals which were resistant to the living organisms and a drop in neutrophiles in those animals which died of shock. A marked lymphocytosis occurs about eight days following the injection of experimental bacilli. This gradually drops in a months time to a moderate degree of lymphocytosis. Monocytes disappear or diminish during the immunizing process and reappear eight days after the injection of living bacilli. The experiments show a new demonstration of the favorable significance of a lymphocytosis in tuberculous infections. The neutrophilia resulting from the infection seems to indicate the marked haematogenous dissemination of exudative foci brought about by massive doses of living bacilli in a sensitized organism. The application of the term "neutrophilic phase of defense" seems justified here. The disappearance of the monocytes is perhaps a favorable sign, in the sense of a reinforcement of antituberculous resistance.—*Comportement clinique et réactions hématologiques chez les lapins immunizés par des variantes S de bacilles tuberculeux tués par chauffrage, F. van Deinse & E. Loukidis, Compt. Rend. de Soc. Biol., January 11, 1936, cxxi, 117.*—(*M. T. W.*)

Immunization against Tuberculosis with Heterologous Bacteria.—Large numbers of guinea pigs and rabbits were immunized with heat-killed organisms, such as typhoid, colon and Bang bacilli, gonococci, staphylococci, and various combinations of these. Ten days after the last injection these animals, together with untreated controls, were given injections of massive doses of virulent human or bovine tubercle bacilli intravenously. It was found that treatment with certain heterologous bacilli, such as typhoid bacilli in conjunction with gonococci, was followed by a somewhat longer survival than those of the controls; on the other hand, immunization with other heterologous bacteria, such as the colon bacillus, was associated with a reduction in the survival period as compared with the untreated controls. Sensitization with horse-serum and casein exerted no effect upon the survival time.—*Ueber Schwankungen der Resistenz gegen tödliche hämatogene Tuberkelbazillen-Infektion nach Immunisierung mit Heterobakterien, S. Nukada & C. Ryu, Zeitschr. Immunitätsforsch., August, 1936, lxxxviii, 496.*—(*M. B. L.*)

Heterologous Bacterial Filtrates and Tuberculous Animals.—In human beings, nonspecific focal and systemic reactions can be observed when tuberculosis is associated with certain infectious diseases or when tuberculous patients are injected with foreign proteins or metallic salts. Bordet found that tuberculous guinea pigs died within a day after intraperitoneal injections of heated bouillon cultures of *B. coli*. The effect of *B. coli* suspensions resembled tuberculin shock. In the present paper the effect of colon, typhoid and meningococcus filtrates on tuberculous animals is described. Guinea pigs and rabbits were used, infected with human or bovine tuberculosis. The bouillon cultures were filtered through Seitz filters, and the various filtrates were tested and found to be potent in the Shwartzman phenomenon. The filtrates were injected into guinea pigs intracardially or intravenously, and occasionally intraperitoneally. The rabbits received the material intravenously. Injections of the filtrates, as with tuberculin, caused haemorrhages about tuberculous lesions and often death in

tuberculous animals. These bacterial products are also injurious to nontuberculous animals, causing intense congestion in some organs, and, when employed in large amounts, death; but toxicity is much less than in tuberculous animals. Bouillon alone, in large dosage, was found to be harmless to tuberculous animals. Many of the guinea pigs receiving the filtrates had symptoms resembling anaphylactic shock, but these symptoms were not observed in the rabbit. Tuberculous animals dying showed haemorrhages and oedema about tubercles and bloody exudate in the serous cavities. The effect of the filtrate is probably due to the increased vulnerability of the blood-vessels of the tissues containing tubercles. Although the effect of the toxic bacterial filtrates in tuberculous animals is similar to that of tuberculin, the mechanism seems to be different. The reaction to the toxic filtrate is due to an increased vulnerability of tissues containing the tuberculous granuloma to a nonspecific injurious substance, while tuberculin or tuberculoprotein is relatively harmless to nontuberculous animals. The toxic effect of tuberculin is due to specific hypersensitiveness induced by the antigen of the tubercle bacilli.—*The Effect of Heterologous Bacterial Products upon Tuberculous Animals, J. Freund, J. Immunol., March, 1936, xxx, 241.*—*(J. S. W.)*

Tuberculous Septicaemia in Immunized and Nonimmunized Rabbits.—Two rabbits were immunized with heat-killed avian tubercle bacilli. They were given living tubercle bacilli twenty-three days later. Two control animals were inoculated with virulent avian bacilli at the same time. Blood cultures were made regularly on all four animals, commencing four hours after inoculation. In the control animals, both of which died three weeks following the inoculation, the blood cultures were positive for tubercle bacilli up to the time of death. In one control animal the disease was complicated by a diarrhoea, at which time the number of bacilli per cubic centimetre of blood markedly increased. In the infected immunized animals blood cultures were positive four hours after inoculation. The bacillaemia disappeared rapidly and completely after a few days, with the exception of one rabbit which had had splenectomy. Four hours following operation the blood cultures were positive. All succeeding cultures were sterile. A concurrent intestinal infection seems to favor the presence of a bacillaemia as does trauma, such as was produced by the splenectomy.—*Etude comparative de la septicémie á bacilles tuberculeux aviaires chez le lapin immunizé et le lapin non immunizé, E. Loukidis & T. Kielanowski, Compt. Rend. Soc. Biol., May 16, 1936, cxxii, 271.*—*(M. T. W.)*

Effect of New Tuberculin on Guinea-Pig Tuberculosis.—The tuberculin was made from bacilli grown on a glycerine bouillon, heated at 120° for 20 minutes, dried and pulverized. This powder was extracted with acetone and then rubbed up with a 0.2 per cent colloidal lecithin solution (1 gm. of powder to 100 gm. lecithin solution). This emulsion was heated under a reflux condenser for one hour, or shaken for 12 to 24 hours at 60°C. The filtrate was then filtered through the Berkefeld candle. In its specific tuberculin potency it was superior to the aqueous extract prepared from these same acetone-treated tubercle bacilli, since more active material was probably extracted in the former case. In one series of experiments, guinea pigs were infected with tubercle bacilli and three months later 10 of them were injected intraperitoneally once or twice a week for three months with 0.1 cc. of 1:1000 to 1:2.5 dilutions of lecithin tuberculin, and 4 were not so treated. One and a half months later in the treated animals the spleens showed no tuberculosis nor could tubercle bacilli be found microscopically in the organs, whereas the untreated animals showed tuberculosis and the presence of tubercle bacilli. The experiment was therefore extended. The animals this time were injected for 5 weeks, once or twice a week, with the tuberculins in greater doses than in the first experiment (0.1 cc. of 1:100, 1:40, 1:20 dilutions, and undiluted up to 2 cc. per dose). Three animals received the lecithin tuberculin from human tubercle bacilli, three the lecithin tuberculin from bovine bacilli, three the colloid lecithin solution itself, and three were untreated. Twenty minutes later all animals were injected with 0.05 mgm. virulent tubercle bacilli. The results showed that the tuberculins gave no protective effect against tuberculosis. In a third series of experiments the technique used in experiment 1 was repeated, except that the tuberculin was a mixture made from human and bovine bacilli and that the treatment with tuberculin was started two instead of three months after infection. A certain amount of healing was noted, but the results were not so striking as in experiment 1. The fourth experiment was undertaken to determine whether the water-extract made from the same acetone-treated bacilli was effective therapeutically. Small doses of these fractions (0.1 cc. of 1:1,000,000 to 1:1000 dilutions), when given once or twice a week for three months, were followed by a certain

degree of effectiveness, which was not as definite as in the first and third series. No therapeutic effect followed treatment with lecithin extracts of tuberculous spleens. Therefore, the tuberculin preparations, when given in proper doses and at proper intervals, are able to stimulate antibody formation.—*Experimentelle Versuche an Tuberkulösen Meerschweinchen mit einem Neuen Tuberkulinpräparate, K. Hedén, Acta Tuberc. Scandinav., Fasc. 4, December, 1935, ix, 336.*—(*F. B. S.*)

Purified Tuberculin.—Research on the chemical nature of the actual reacting substance of tuberculin has been somewhat overlooked. However it is admitted that the substance belongs to either the group of proteins or proteoses. In filtrates of cultures of tubercle bacilli in the synthetic medium of Sauton two-thirds of the complex nitrogenous substances which diffuses in the course of bacillary vegetation is precipitated by trichloracetic acid. The other one-third is precipitated by phosphotungstic acid in the presence of sulphuric acid. On the other hand, if filtrates are precipitated directly with phosphotungstic acid and if the precipitate is taken up with barium oxide, proteins and specific proteoses of bacillary origin which actually constitute the totality of the tuberculin substance of the medium may be separated in almost pure form. A method of precipitation, given in detail, is composed of phosphotungstic-sulphuric-acid digestion and precipitation, washing with fifth-normal sulphuric acid, triturating with pure barium hydroxide, more washings, and finally filtering. The yellowish amber-colored fluid thus obtained is clear and stable, unlike suspensions made by precipitating with trichloracetic acid alone. The tuberculin sensitivity is in general constant when measured by skin tests. Toxicity is even less for the guinea pig than that produced by raw tuberculin. The new guinea pig can stand 20 mgm. of the dry product intravenously without difficulty. A weak dose of the phosphotungstic precipitate does not confer any appreciable cutaneous anaphylactic or allergic sensitivity in the guinea pig. Consequently, after certain perfections are made in the preparation of this product it may be advantageously substituted for raw tuberculin in the common practice of intracutaneous tests.—*Assai de préparation d'une tuberculine purifiée, A. Boquet & G. Sandor, Compt. Rend. Soc. Biol., January 11, 1936, cxxi, 99.*—(*M. T. W.*)

Haemorrhagic Skin Reactions to Tuberculin in Immunized Guinea Pigs.—During studies previously reported on the allergic state in guinea pigs conferred by the inoculation of dead tubercle bacilli emulsified in vaseline, a number of haemorrhagic skin reactions were noted in the animals tested with tuberculin. Only in certain cases did this haemorrhagic response occur, while in certain other cases the allergic reaction was manifested by the appearance of an oedematous papule. Experiments were made to determine the cause of the difference in reactions. It was found that the greatest number of haemorrhagic reactions occurred in animals receiving the dead tubercle bacilli intratesticularly. Intrapulmonary inoculations produced the second largest number of positive reactions and the subcutaneous method gave the lowest number. Second, it was observed that, while the haemorrhagic reactions occurred with inoculations of dead tubercle bacilli of different types, the intensity of the reaction depended upon the strain of bacilli used. For instance, the inoculation of dead bovine bacilli produced a greater percentage of haemorrhagic reactions than did *BCG*, and apparently human bacilli, although this point is to be developed further. Dead tubercle bacilli of different types, emulsified in vaseline oil and inoculated into guinea pigs by subcutaneous, intrapulmonary and intratesticular methods, produce an allergy demonstrable by particularly intense haemorrhagic skin tuberculin reactions, reminiscent of the Sanarelli-Schwartzman reaction.—*Réaction tuberculinique hémorragique particulièrement intense obtenue des cobayes par l'inoculation de bacilles tuberculeux morts enrobés dans l'huile de vaseline, A. Saenz, Compt. Rend. Soc. Biol., March 7, 1936, cxxi, 957.*—(*M. T. W.*)

Intraphagocytic Destruction of Tubercle Bacilli.—The mechanism by which the reduction or destruction of tubercle bacilli in infected individuals is brought about is not entirely agreed upon. Increased resistance to tuberculosis in animals may be due to an inhibitory action by the tissues or to direct lysis of the tubercle bacilli. In the experiments reported, an attempt was made to determine whether tubercle bacilli could be reduced significantly outside of the body in the presence of living mononuclear leucocytes and normal or immune serum. The relation of the degree of lysis to the concentration of antibodies (agglutinins) in the sera and to the allergic state in the animals from which the sera or leucocytes were obtained was also studied. The degree of lysis was estimated from the degree of failure of the bacilli to take the Ziehl stain or to be stained by ordinary methods. The strain of tubercle bacillus, used both for immunizing the animals

(rabbits) and for the experiments in lysis, was *BCG*. This organism was used because of less possible danger to the worker and because immune serum could be developed in animals without producing tuberculosis. The monocytes were obtained in almost pure suspension by injecting paraffin-oil into the peritoneal cavity of rabbits, killing the animals in four days, and washing the cells free from the cavity contents. All salt solutions used in the experiments contained 0.1 per cent gelatin. The suspension of bacilli was prepared by grinding the organisms in a mortar in physiological salt solution and then centrifugating to throw down visible clumps. The suspension was finally diluted to show about 1,500 bacilli per 25 oil-immersion fields. The immune sera were obtained from rabbits, vaccinated with *BCG* so as to obtain high antibody titres in the sera of some animals and low titres in others. The sera were diluted 1–25 for the tests. This dilution, when mixed with equal volumes of suspensions of leucocytes and bacilli, gave a final dilution of 1–75. The leucocyte suspensions were diluted and gauged by their turbidity, so that 25 oil-immersion fields from the mixture of cells, serum and bacteria on the slide showed approximately 350 mononuclear leucocytes. Thus, to 0.1 cc. of the suspension of leucocytes were added equal amounts of the bacterial suspension and diluted immune serum. One measured drop of the mixture was spread evenly over a measured surface (6.25 sq. cm.) on a glass slide, fixed with alcohol and stained. The vials containing the mixtures were also stoppered and rotated for one hour at 37°C. and similar smears made. The number of leucocytes and the number of bacilli outside or within the leucocytes were counted in 25 oil-immersion fields on each slide and the percentage of disappearance of organisms calculated. The following combinations were studied: (1) bacilli + gelatin solution; (2) bacilli + normal or immune serum; (3) bacilli + normal leucocytes; (4) bacilli + normal leucocytes + normal serum; (5) bacilli + normal leucocytes + immune serum; (6) bacilli + normal leucocytes + various concentrations of immune serum; (7) bacilli + leucocytes from animals which were both allergic and immune to *BCG*. The combination, bacilli + normal leucocyte + normal serum, when incubated for one hour usually showed a degree of phagocytosis, but the total number of bacilli seen either outside or within the leucocytes always approximated the number in the suspension before incubation; hence, this combination was used as a standard for comparing the degree of lysis in the further studies. *Results:* When the only variable factor was the serum, 32 immune sera gave 68 per cent average lysis as compared with no lysis with 8 normal sera. When the immune sera (32) showed varying degrees of agglutinins with titres ranging from 1–50 to 1–6400 the percentage of lysis rose from 25 to 95 per cent. When either the leucocytes or serum from animals allergic as well as immune was utilized, no material difference occurred in the results. The ability of the serum to bring about lysis of tubercle bacilli through mononuclear leucocytes appears to bear no necessary correlation to the phenomenon of allergy. A lysis of tubercle bacilli, phagocytosed by mononuclear leucocytes, is a probable method of destroying the organism in the tuberculous infected body.—*The Destruction of Tubercle Bacilli within Phagocytes in Vitro, B. J. Clawson, J. Infec. Dis., January–February, 1936, lviii, 64.*—*(J. S. W.)*

Fate of Phagocytized Acid-fast Bacteria.—The early outpouring of polymorphonuclear leucocytes following the injection of different strains of tubercle bacilli is well known. The later stimulation of monocytes, epithelioid cells and clasmatocytes is characteristic of infection with mycobacteria. All these phagocytic cells engulf tubercle bacilli with remarkable rapidity. It seemed important to determine the fate of these bacilli. Whether or not these organisms were viable might be demonstrated if cells which had harbored these bacteria for a known length of time could be isolated and transplanted to favorable mediums. The microdroplet single-cell technique seemed admirably suited for this purpose. The polymorphonuclears used in the experiment were obtained by injecting aleuronat into the peritoneum of normal guinea pigs. After 24 hours the guinea pig was killed, and the peritoneal exudate diluted with Ringer's solution containing heparin, and withdrawn. Varying amounts of bacilli were added to the cell exudate and the tubes incubated. The best concentration was found to be from one to three organisms for every phagocytic cell as determined by a modified Ziehl-Neelsen stain. The leucocytes and microörganisms were incubated for twenty-four to forty-eight hours with frequent gentle machine shakings to ensure adequate distribution. The single-cell method was then employed for manipulating the leucocytes, and, finally, such of these as had been freed from all unphagocytized bacteria ("washed"), were taken up with a fresh micropipette and planted on Petroff's egg medium. Engulfed mycobacteria in living leucocytes can with difficulty be distinguished from the surrounding cell; hence, to ensure the presence of cells con-

taining organisms, a large number of cells were utilized for each experiment. When 10 or more per cent of leucocytes were seen to contain microörganisms, from 100 to 200 washed cells were planted on each tube of medium. The use of oil to stimulate the production of leucocytes was found unsatisfactory when the action of the leucocyte upon engulfed organisms is of importance. The oil may dissolve some of the bacillary substance, and tends to inhibit their growth. With the single-cell technique, such as outlined, the action of polymorphonuclears on iguana tubercle bacilli and H37 human tubercle bacilli was studied. Also, the non-acid-fast *B. subtilis* was used to serve as a further control. The leucocytes were incapable of destroying a rapidly growing organism, such as the inguana bacillus, in spite of the fact that such leucocytes engulfed the bacteria avidly. The bacteria may remain in the living cell for one or two days and suffer no apparent injury. When the H37 strain of human tubercle bacillus was employed, however, the polymorphonuclears combated them effectively, at least under the conditions of the experiment. None of the slants inoculated with washed leucocytes containing these organisms gave rise to growth after twelve weeks of incubation. When *B. Subtilis* was used, the bacteria were promptly engulfed and did not multiply within the cell. The agar slants, containing the "washed" leucocytes, never exhibited growth.—*The Fate of Phagocytized Acid-fast Bacteria as Determined by the Single Cell Method. I. Polymorphonuclear Leucocytes, M. Hotopp & M. C. Kahn, J. Infect. Dis., May–June, 1936, lviii, 324.*—(*J. S. W.*)

Reticuloendothelial System in Immunity to Tuberculosis.—Splenectomy and injury to the reticuloendothelial system by colloidal copper have no effect on the progress of tuberculous infection in guinea pigs. Nor does this treatment influence the development of immunity to reinfection resulting from first infection of nonprogressive character. There is no significant difference in the number of tubercle bacilli that can be cultured from the organs of blockaded and nonblockaded reinfected animals. Therefore, immunity to tuberculosis does not depend solely upon the intactness of the reticuloendothelial system. As Selter contends, the essential mechanism is an alteration in the physicochemical state of the cells, which is of such a character that the cells do not react to the tubercle bacillus, despite its presence in the body.—*Welche Bedeutung ist dem retikulo-endothelialen System bei der aktiven Immunisierung gegen Tuberkulose zumessen, F. Weiland, Ztschr. Immunitätsforsch., August, 1936, lxxxviii, 460.*—(*M. B. L.*)

Allergy and Tuberculosis.—Following infection of guinea pigs with large doses of tubercle bacilli, tuberculin skin sensitiveness was first noticeable grossly after 96 hours and microscopically as an infiltration with mononuclear cells after 72 hours. The primary lesions, subcutaneous, testicular, and intraperitoneal, showed numerous polymorphonuclears within a few hours and abscess-formation in 48 hours. By 72 hours the abscess was surrounded by a zone of large mononuclears, which gradually spread and replaced the majority of the granulocytes and rapid fibroblastic proliferation resulted in true fibrous encapsulation. Therefore, bacterial allergy seems to appear coincidently with the histological change from a simple pyogenic to a granulomatous response.—*Influence of Allergy on Development of Early Tuberculous Lesions, L. Dienes & T. B. Mallory, Proc. Soc. Exper. Biol. & Med., February, 1936, xxxiv, 59.*—(*F. B. S.*)

Allergy from Dead Tubercle Bacilli in Vaseline.—Dead tubercle bacilli were emulsified in vaseline oil so that 1 cc. contained 1 mgm. bacteria. One cubic centimetre was inoculated subcutaneously into two series of guinea pigs,—17 animals. These became positive to tuberculin about the sixth day, with red oedematous papules. From the fifteenth to the twentieth days the reaction became necrotic and haemorrhagic. An increase of the dose did not seem to increase the intensity of the reaction nor the length of the anteallergic period. Three series of guinea pigs inoculated with 1 or 10 mgm. of dead tubercle bacilli emulsified in physiological salt solution failed to show any tuberculin sensitiveness with the exception of two which showed weakly positive reactions. Tuberculin sensitiveness, produced by the inoculation of dead tubercle bacilli emulsified in vaseline, was found to be four times more intense than one produced by bacilli in normal salt solution and twice as strong as one produced by inoculation of living virulent bacilli. Inoculation of oil alone fails to produce any tuberculin sensitization.—*Accroissement de l'état allergique et titrage de la sensibilité tuberculinique conférés au cobaye par l'inoculation sous-cutanée de bacilles tuberculeux morts enrobés dans de l'huile de vaseline, A. Saenz, Compt. Rend. Soc. Biol., December 14, 1935, cxx, 1050.*—(*M. T. W.*)

Allergy and Immunity Resulting from Ghon Tubercle.—The effect of allergy resulting from a Ghon tubercle on subsequent immunity has had various interpretations. Some feel that the more severe secondary pulmonary infection or fatal tuberculosis is the result of this allergy. Others are of the opinion that a degree of immunity (resistance) is associated with nonprogressive primary tuberculosis. Although allergy may be at times harmful, the presence of increased resistance is all important. It is difficult to harmonize these observations. Four important factors, however, should be considered: (1) the degree of allergy, (2) the virulence of the infecting organism, (3) the frequency of reinfection, and (4) the size of the reinfecting dose. The first factor can be determined in the patient, but there is no means of measuring the virulence of the organism and the frequency and extent of reinfection. It is doubtful whether the virulence of the infecting bacilli can regularly be greater in reinfection than in primary infection. The two variable factors, then, which cannot be measured in human tuberculosis are the number of infections and the size of the infecting doses. Several series of rabbits were made allergic and later infected with virulent bacilli, to study the relation between allergy and resistance in the pathogenesis of pulmonary tuberculosis. The *BCG* (bovine) strain of tubercle bacilli was used to render the animals allergic, as it does not produce progressive tuberculosis, thus making it possible to reproduce closely in rabbits the condition found in patients with healed or nonprogressive Ghon tubercles. The *BCG* was administered as follows: (1) subcutaneous injections of living bacilli, (2) intravenous injections of dried clumps, (3) intrapulmonary injections of living bacilli with a long needle in the trachea, and (4) with a long needle through the thoracic wall and pleura. The last method proved the most efficient in producing localized nonprogressive lesions in the lungs (experimental Ghon tubercles). Allergy readily developed with all the methods in two to three weeks. With the exception of the first group of animals the allergy was due to lesions in the lung. Eight weeks after the inoculation of the *BCG* all the allergic animals and a series of normal animals were given subcutaneous injections (0.01 mgm.) of a virulent strain of bovine tubercle bacilli. All the animals were killed 45 days after this injection, and the degrees of tuberculosis in the lungs and kidneys of the normal and the allergic animals were compared. In group 1 all the normal animals showed tuberculosis either in the lungs or kidneys or both, whereas no tuberculosis was noted in these organs in the allergic animals. Group 2 gave a similar result, except that three out of the 12 allergic animals showed a slight infiltration of the lungs. The results in group 3 closely approximated those in group 2. The method of sensitization used in group 4 proved the most constant in producing Gohn tubercles. Nodular areas were produced in the lungs in practically all animals. Well-developed tubercles were observed in about two weeks. In the Ghon-tubercle group none of the animals developed lesions in the lungs and kidneys, and only 3 (out of 12) showed a few tubercles at the point of injection of the virulent strain. On the contrary, all the normal animals had subcutaneous as well as visceral lesions. In the Ghon-tubercle group, allergy began to appear as early as eleven days after the *BCG*, and was frequently well established by fourteen days. These experiments show that allergic rabbits, including those with a Ghon tubercle, have a marked degree of resistance against further tuberculous infection. Previous experiments have shown that this resistance can be developed as well by a method in which allergy does not occur. The fact that allergy occurs so early in the development of tubercles does not support the theory that the factor causing the severe secondary or adult type of pulmonary tuberculosis is allergy, for evidently all tuberculosis, both childhood and the adult type, even before it can be observed anatomically or clinically, is associated with and influenced by allergy. Some factor or factors other than allergy should be sought to account for the more extensive secondary or adult type of pulmonary tuberculosis which may occur in patients who already have a nonprogressive Ghon tubercle.—*Importance of Allergy and Immunity Due to a Ghon Tubercle in Pathogenesis of Experimental Pulmonary Tuberculosis, B. J. Clawson, Arch. Path., July, 1936, xxii, 99.*—(*J. S. W.*)

Allergy from Ingestion of Dead Tubercle Bacilli.—Ten guinea pigs were fed, with a pipette, three doses of dead tubercle bacilli suspended in oil of vaseline, and tuberculin-tested at intervals. Seven of these became positive to tuberculin after the fifteenth day. All became positive later, and remained so for six months. Another series was given single doses, containing as many dead organisms as in the first experiment. Except for one animal, these all became tuberculin-positive. These animals all remained positive to tuberculin for six months. Two series of control guinea pigs, fed dead tubercle bacilli suspended in sterile water, failed to show reactions to tuberculin at any time. They were killed

in order to observe the mechanism of this sensitivity. All sensitized animals showed hypertrophied tracheobronchial lymph nodes and small areas of bronchopneumonic tuberculosis. The bacillary emulsion of dead tubercle bacilli had thus penetrated the upper respiratory tract, producing specific cellular reactions and intense allergy.—*Etat d'allergie intense, rapide et durable, conféré au cobaye par ingestion de bacilles tuberculeux morts enrobés dans l'huile de vaseline; son mécanisme, A. Saenz, Compt. Rend. Soc. Biol., November 30, 1935, cxx, 870.—(M. T. W.)*

Fatal Results of Allergy.—Reports have been made concerning a special type of tuberculosis in rabbits designated as septicaemia of the Yersin type. This is produced in the rabbit by large intravenous doses of bovine tubercle bacilli and certain S variants. It is marked by the total absence of lymphatic involvement. There are two distinct clinical types of the disease. In the one case the animal becomes rapidly emaciated and dies. In the other, it appears well, suddenly has convulsions, and dies. Death has been attributed to an allergic state, but without experimental proof. Experiments were thus made to try to elucidate this problem. Repeated intravenous inoculations of four different strains of heat-killed tubercle bacilli, S variants, were made into rabbits. Rabbits thus treated develop sensitiveness to such an extent that the last injection brings on death. Lesions at autopsy markedly resemble the lesions of animals dead of septicaemia of the type Yersin. It is thus possible that death in both instances is due to a state of shock.—*Sur les effects des injections intraveineuses, chez le lapin, de variantes S du bacille tuberculeux tué par chauffrage, F. van Deinse, Compt. Rend. Soc. Biol., December 14, 1935, cxx, 1063.—(M. T. W.)*

"Blockade" of Tubercle Bacilli in Immune Animal.—When tuberculous or vaccinated guinea pigs are reinfected by subcutaneous or intracutaneous inoculations, the bacilli of reinoculation remain fixed in place during an immune period before being taken up by the lymphatics and bloodstream. A series of experiments was performed to definitely prove this point first established by Krause and Willis. Guinea pigs were inoculated into the right inguinal region with a virulent S variant of bovine tubercle bacilli. Two months later the animals were reinoculated into the subcutaneous tissue of the left leg with a virulent human R strain of tubercle bacilli. Animals thus reinfected, together with control animals, were killed three, seven, twelve, and fifteen days later. Observing customary aseptic technique, the inguinal lymph nodes and spleen were ground up and cultured. Only S colonies of the primary infection appeared on the culture tubes from guinea pigs killed up to and including the twelfth day following the reinfection. R colonies appeared together with numerous S colonies on cultures of the guinea pigs killed on the fifteenth day after reinoculation. This showed that the experimental tubercle bacilli of reinfection remain blocked at the site of inoculation for a period of two weeks. This method, which shows evidence of the phenomenon of immunological blocking, is applicable to the study of the fate of microorganisms of reinfection, inoculated by various routes and in any number of various circumstances. It is particularly applicable to the controversial question of bacteriolysis of bacilli of experiment.—*Sur la dispersion des bacilles de surinfection dans l'organisme des cobayes tuberculeux, A. Boquet & R. Laporte, Compt. Rend. Soc. Biol., January 18, 1936, cxxi, 211.—(M.T. W.)*

Desensitization of Tuberculous Guinea Pigs.—It has long been recognized that injections of tuberculin repeated at brief intervals produce progressively attenuated reactions. This tolerance to tuberculin has been observed in both man and the guinea pig. Very old experiments were made on man and cattle on desensitization of the skin. With guinea pigs made allergic by the inoculation of bacilli of low virulence, skin desensitization has been partially proved by Boquet. He has also shown that skin sensitivity may be attenuated in the tuberculous guinea pig. Experiments were thus undertaken with the idea of obtaining complete desensitization of the skin by prolonged treatment with tuberculin in tuberculous guinea pigs. A series of infected guinea pigs were given tuberculin daily for ten days. This produced a state of tolerance interpreted as a progressive desensitization of the skin. This appeared about the time of the second or third desensitizing injection. It became complete or almost so about the tenth day. It lasted only for a period of ten days on an average. This desensitization manifested itself by the tolerance of the tuberculous animal to tuberculin intoxication and also to peritoneal injections of dead bacilli which kill the nondesensitized allergic animal in a few hours. The injection of a large dose of tuberculin at the end of the desensitizing treatment increases the skin desensitization without prolonging the duration of the tolerance. On the contrary, injections of large doses of dead bacilli into animals de-

sensitized by tuberculin seem to promote a rapid return of skin sensitivity.—*Essais de desensibilisation des cobayes tuberculeux, E. Carlinfanti, Compt. Rend. Soc. Biol., January 25, 1936, cxxi, 304.*—(*M. T. W.*)

Duality of Antigens of Avian Tubercle Bacilli.—It has been previously shown that avian tubercle bacilli contain a specific antibody capable of producing complement fixation with antiavian serum primarily deprived of their group antibodies by absorption of an acid-fast bacillus of another species. Not all avian bacilli react to the same degree to avian serum but show a different fixation power according to serum used. Experiments were performed to show whether or not there exists a different antigenic structure among the various avian strains. Two avian antisera were prepared with two different avian strains. Their behavior was studied, side by side with several avian, human, bovine and a new guinea-pig strain. The sera were studied by themselves and after absorption with different avian, human, bovine and paratuberculous bacilli. The following conclusions were drawn: The bacillus of avian tuberculosis contains three different antigens. One is of a group common to all acid-fast organisms, human, bovine, avian, the new guinea-pig strain and paratubercle bacilli. A second is specific for a type of avian tubercle bacilli. Two types of avian bacilli may be differentiated, each reacting to the corresponding antiserum. The third antigen is specific for one of two types of avian tubercle bacilli. The bacilli of the same type absorb all the antibodies of the other type, while the bacilli of the other type absorb only the antibodies of its own type. Each is constituted by bacilli having a common antigenic composition.—*L'existence de deux types seriologiquement distancts du bacille de la tuberculose aviaire, W. Schaeffer, Compt. Rend. Soc. Biol., December 21, 1935, cxx, 1185.*—(*M. T. W.*)

Respiratory Muscles as Factor in Dyspnoea.—There are cases of heart and lung disease in which the existence and severity of dyspnoea bear little relation to disturbances in the acid-base equilibrium or in the aeration of the blood. Comparative observations were made on a dyspnoeic patient, on a patient who was cyanotic but not dyspnoeic at rest, and on a normal adult male. Of the two patients, both of whom suffered from advanced pulmonary tuberculosis with fibrosis, one was dyspnoeic at rest without being cyanotic, the other had arterial anoxaemia with an oxygen saturation of the arterial blood at rest of 88 per cent. The vital capacities of the dyspnoeic and anoxaemic patients were 2.42 litres and 2.16 litres, respectively, in the supine position. It was found that the increased dyspnoea which occurred with exercise in the first patient was not associated with oxygen unsaturation of the arterial blood, and that there were only small changes in the acidity and carbon dioxide tension of the blood. These latter changes were less than those after similar exercise in the anoxaemic patient who was scarcely rendered dyspnoeic. Concentrations of carbon dioxide eliminated in the expired air and of oxygen absorbed were nearly the same as in the normal subject. During "fast exercise" the concentrations were lower. They were, however, much higher than those of the anoxaemic patient. In the dyspnoeic patient the vital capacity was observed to increase after cessation of exercise, and the period of dyspnoea following exercise was brief. The chest of the dyspnoeic patient was flat anteriorly, with the upper part permanently elevated. The ribs were more horizontal than normal, and the intercostal spaces were wide. Both leaves of the diaphragm were low and flattened. The patient's characteristic respiratory movement was of upper costal type. On inspiration, the entire anterior part of the chest moved upward and without lateral expansion of the lower ribs. During expiration, the sternocleidomastoid and scalene muscles remained hypertonically contracted as the anterior part of the chest moved downward. The contraction of the upper costal muscles preceded any visible contraction of the diaphragm. The latter occurred only during the last part of the inspiratory cycle. Thus there was a reduced costodiaphragmatic respiration which failed to synchronize with upper costal respiration. With voluntary deep breathing, however, the diaphragm moved 4 to 5 cm. and there was good synchronization, but with persistence of the upper costal type of breathing. Measurements made of quiet breathing revealed increased ventilation, rapid rate, small depth, variable midposition, and an increase in the time required for the inspiratory phase. These abnormalities are characteristic of the respiration of a patient with bronchial or tracheal obstruction. None was present in this case. There was a decrease in the reserve and complemental air, and a relative increase in residual air in both patients when at rest. Studies of the pleural pressures of the dyspnoeic patient indicated only a moderate degree of impairment of the elasticity of the lung tissue. In the anoxaemic patient exercise resulted in a sharp increase in the rate of respiration with little alteration in amplitude. In the dysp-

noeic patient, both shallow and deep respirations were greatly retarded throughout inspiration and expiration during exercise. This is suggestive of some resistance to breathing. Occasionally there would be a respiration of considerable amplitude accomplished rapidly. The amplitude of many respirations was such as to indicate the use of both upper costal and costodiaphragmatic musculature. The total ventilation did not increase appreciably during the first minute of exercise: at times it was even decreased. Aeration of the blood remained normal, however; perhaps because the occasional deep respirations offered a large breathing surface. By the end of one minute of "fast exercise" there was an insupportable sense of distress which required cessation of the exercise. Immediately on stopping the exercise, the speed of the individual respirations increased greatly, and the respirations became rapidly regular and of average amplitude, with a resulting great increase in pulmonary ventilation. Fluoroscopic studies showed normal synchronization of the diaphragm and upper chest muscles and an increased diaphragmatic excursion. The vital capacity increased. The recovery period was only two minutes. Injection of epinephrine hydrochloride, 1 mgm., or of atropine sulphate, 1 mgm., did not alter the results. The explanation given of this patient's dyspnoea lies in a lack of coördination, with resulting antagonistic action and spasm of the muscles involved in costodiaphragmatic respiration. One hesitates to regard this as a manifestation of neurosis, and may believe that it may have resulted from a reflex disturbance initiated by the fibrosis of the lung tissue and the ensuing loss of elasticity. In such cases the value of muscle training is very great, as evidenced by the improvement in respiratory function and exercise tolerance which was accomplished in this patient.—*Disturbance of Action of Respiratory Muscles as a Contributing Cause of Dyspnea, A. Counard, H. J. Brock, I. Rappaport & D. W. Richards, Jr., Arch. Int. Med., May, 1936, lvii, 1008.*—(*C. L. D.*)

Dysphagia Due to Unilateral Pulmonary Fibrosis.—Pulmonary disease is a very rare cause of dysphagia. It occurs with pleurisy with effusion and with pain of diaphragmatic pleurisy. Previous reference to its association with pulmonary fibrosis has not been found. A tuberculosis dispensary nurse, aged 45, gave a history of cough following reputed pneumonia at 16, and six months later entered a tuberculosis sanatorium, remaining a few months, after which she kept well until February, 1934, except for two attacks of influenza. In July, 1934, she complained of hesitant and difficult speech and in March, 1935, of dysphagia, also of some epigastric pain, flatulence and acid eructations. She had no cough or sputum when admitted to Oakwood Hall Sanatorium, September 9, 1935, but showed signs of marked fibrosis of the left lung with pleural thickening at the base, and slight cardiac displacement to the left. X-ray examination revealed a marked dimming of the left chest, especially basal, with trachea retracted and diaphragm invisible; lateral films showed it elevated. The tuberculin reaction was strongly positive. Films taken while swallowing a barium preparation showed the oesophagus curved markedly to the left just above the sternoclavicular joint and narrowed at the level of the 1st costal cartilage. The examination was repeated a few days later to obviate the possibility of muscular spasm as a cause of narrowing, and showed the same appearance. The cause of the dysphagia in this case was evidently torsion on the oesophagus by the unilateral pulmonary fibrosis. It is recalled that the patient had been advised to have a sound passed, an obviously risky procedure. Six other cases of unilateral pulmonary fibrosis were likewise investigated, five of them undoubtedly due to old tuberculosis, and the sixth to bronchiectasis, the result of massive atelectasis. Five of the six showed marked oesophageal displacement; the sixth patient, who had a thoracoplasty, moderate. None had symptoms of dysphagia or dyspepsia or showed stricture.—*Dysphagia due to Unilateral Pulmonary Fibrosis, A. T. Doig, Brit. M. J., March 7, 1936, no. 3522, 468.*—(*A. P.*)

Blood Picture and Indices in Pulmonary Tuberculosis.—Definite changes in the blood are associated with different phases of pulmonary tuberculosis, but individual reactions are so variable that correlation with the clinical condition presents many difficulties. Especially in human patients do discrepancies exist between different blood criteria, and to rely solely upon the evidence of one aspect of the picture is misleading. The present investigation was made at Colindale Hospital, London, where patients were studied in all stages, modern facilities for observation and treatment were available, and most of the tests were on adult males. *Criteria and Methods:* Criteria employed were (1) the von Bonsdorff modification of the Arneth count; (2) the differential leucocyte count; (3) the red-cell sedimentation rate. Eventually the total leucocyte count was discarded because of the added time and labor without adding any more

real information than was obtainable from the differential. Blood samples were always taken as near 12 noon as possible. Venous blood is believed less subject to variation from local conditions than that extruded from tissues by the stab method. Smears were made according to Schilling's methods and stained with Leishman's stain. *Differential counts:* Monocytes appear as large, faintly granular cells with a round or horseshoe shaped nucleus, showing finely drawn basi-chromatin. Other terms applied are "large hyaline leucocytes" and "transitional leucocytes" (Ehrlich). In estimating percentages 200 or more cells were counted. *Von Bonsdorff count:* In properly made smears the enumeration of the nuclei of the neutrophiles is not difficult. Slides must not be too thick. *Sedimentation rate:* The Westergren method was used. Over 2,000 blood examinations on these lines were carried out. *Red-Cell sedimentation:* This is the easiest to carry out and least liable to technical error; hence most generally used. By itself, however, it has little prognostic value. Instances are not uncommon in which the rate remains within normal limits despite undoubted evidence of an active lesion; *vice versa*, a rapid sedimentation rate may occur with very chronic or healed lesions and with little or no toxaemia. Disturbance of metabolism is the preponderant factor, and rapid sedimentation was always found associated with dyspnoea and in the "bronchitic type." Prolonged bed-rest, except in very advanced cases, often reduces it to normal, without corresponding improvement in other aspects of the blood picture. *Differential count:* Special importance is attached to the relative proportions of 3 key types of cells, neutrophiles, lymphocytes and monocytes. Apart from minor fluctuations, the percentages of these types of cells remained fairly constant in the absence of clinical change in the patient, but repeated counts at intervals during treatment showed very definite changes as improvement or the reverse occurred. Haematologists differ in opinion as to the variations occurring in normal individuals. Shaw has shown that there are two daily tides in the leucocyte count, with a variation of 2,000 or more during each. The day-tide begins in the forenoon, reaches flood in the afternoon, and ebbs in the evening. The night-tide begins in the late evening, reaches its height some time after midnight, and ebbs in the day. These tides occur regardless of food and exercise. *Von Bonsdorff count:* This is the sum of the nuclei in 100 neutrophiles, 275 being a high normal. In pulmonary tuberculosis there is invariably a shift to the left, the lowest count found being 120, indicating a predominance of immature cells. This count is a reliable index of toxaemia, but bears no relation to extent of disease and but a variable one to activity. *Determination of combined index:* Houghton tried to balance those features of the blood picture which can be classified as assets against the liabilities: lymphocytes and eosinophiles were put on the "credit" side, neutrophiles and monocytes on the "debit" side. The von Bonsdorff goes on the credit side, the sedimentation rate on the debit side. An *Index* was formulated thus: V. B. — (S. R. + (P + M − 2L)). (V. B. is von Bonsdorff count, S. R. the sedimentation rate, P the neutrophiles, M monocytes and L lymphocytes.) Each component varied from 0 to 100 and carried a uniform weight, except the lymphocytes, which were doubled. A table, for rapid use in determining the poly:lympho:mono ratio, varied from −50 to +55. To it was added the sedimentation rate and the sum subtracted from the von Bonsdorff figure. The index varied from a maximum of 300 in the best cases to about 0 in the worst. Actually, anything over 260 was considered satisfactory. *Follow-up prognosis:* Of 63 patients with an index under 120 on admission, 72 per cent died during their residence, and, of those surviving and leaving, 60 per cent died within a month or two. According to further information on 107 cases, excluding "bronchitics," their progress was generally in accordance with expectations from their blood indices. Of those with indices above 180, 84 per cent are reported at work; while below 120, 60 per cent are dead and 36 per cent reported "unfit." Tests during acute exacerbations, (acute pleurisy or exudate (in pneumothorax?)), give unduly depressed pictures. Improvement under routine treatment was usually reflected only in the sedimentation rate. Generally, an index of 200 on completion of treatment seemed to be the minimum compatible with a reasonably good prognosis. Normals of 260 to 300 were practically never reached. With successful artificial pneumothorax the changes may be striking. Those with low von Bonsdorff count but relatively good lymphocyte percentage did best. The term "bronchitic blood picture" is applied to that commonly encountered in patients in whom bronchitic symptoms were prominent but not invariably present. These patients do poorly under collapse therapy, become short of breath readily, lose weight, and have unfavorable constitutional reactions. The features of the blood picture are (1) a relatively high von Bonsdorff count; (2) a relatively rapid sedimentation rate; (3) a relatively good lymphocyte picture. Such cases usu-

ally suffer from a chronic fibroid type of disease, with but little tuberculous toxaemia but deficient pulmonary aeration.—*The Blood Picture in Pulmonary Tuberculosis, L. E. Houghton, Tubercle, November, 1935, xvii, 49.—(A. P.)*

Differential Diagnosis of Pulmonary Tuberculosis.—The following clinical points are emphasized: *1:* A family history of contact with tuberculosis or other opportunity for contagion may have an important bearing. *2:* A past or present history of haemoptysis out of a clear sky is especially suggestive of pulmonary tuberculosis. Bleeding due to malignant tumor is the chief exception. Haemoptysis, although common in bronchiectasis, is rarely initial. *3:* Primary pleurisy with effusion is equally significant. It also occurs with neoplasm, extension from a primary bronchogenic carcinoma being much more common than primary endothelioma. Pulmonary infarction after operation, delivery or trauma, may also give rise to an effusion. The diagnostic odor of the sputum is of some importance. In bronchiectasis, it is stale and musty in about half the cases and usually foul in lung abscess. The use of tuberculin tests is most valuable in youth to screen out negative reactors and the leucocyte count is of some importance because of the usual absence of leucocytosis in uncomplicated tuberculosis. Primary pulmonary tuberculosis is characterized by diffuse or nodular lesions anywhere in the lung, together with tracheobronchial lymph-node involvement. Its onset is insidious and the outlook good, but resolution slow, with calcification and fibrosis. Acute pneumonic conditions give a more stormy onset, with usually a leucocytosis and relatively rapid resolution. Acute pneumonic phthisis may simulate acute pneumococcus lobar pneumonia, but the initial complex of the latter,—chill, rapid elevation of temperature, cough and rusty sputum,—is seldom complete. Pallor is more common than cyanosis. Absence of leucocytosis, irregular or persistent temperature curve, and evidence of apical or subapical involvement, all suggest tuberculosis; also, the sputum is usually positive. Delay in early diagnosis of the chronic ulcerative form of tuberculosis is largely due to a prolonged latent period without significant symptoms or signs. It is then recognized by X-ray. Beyond this the evolution and symptomatology are fairly uniform. It is emphasized that physical signs may be negative with early active or indolent deep-seated lesions. On the other hand, persistent fine or medium moist râles in certain regions give added significance to otherwise doubtful X-ray shadows. One condition in which the value of physical signs exceeds that of the X-ray is obstruction atelectasis. However, fine or coarse mottled densities above the 3rd rib anteriorly are seldom due to anything but tuberculosis. Of special methods, lipiodol is seldom necessary, except in establishing the diagnosis of bronchiectasis and occasionally assisting in the localization of lung abscess. Supraglottic instillation after postural drainage is usually as satisfactory as the bronchoscopic method. With symptoms or signs suggesting malignant tumor or foreign body, or in cases of localized pulmonary suppuration, bronchoscopy should be considered.—*The Differential Diagnosis of Pulmonary Tuberculosis, F. T. Lord, Meeting Mass. Med. Soc., June 5, 1935, reported in New England J. M., December 12, 1935, ccxiii, 1181.—(A. P.)*

Differential Diagnosis of Pulmonary Tuberculosis and Mycotic Infections.—Despite the fact that fungi have been recognized as pathogenic to man, for half a century, their diseases form a general group of ill-defined and poorly recognized clinical entities. Watkins has proposed a useful classification, dividing fungi into 3 main groups: (1) filamentous, (2) yeast-like and (3) more complex forms. The first includes actinomyces, cohnistreptothrix, leptothrix, vibriothrix, cladothrix and anaeromyces, biologically related to the tubercle bacillus, especially streptothrix, which stains with variable acid-fastness. Pulmonary actinomycosis is a typical example of this group. The patient may present the familiar picture of loss of weight, cough, fever, haemoptysis and sweats. But usually the basal or hilar portion of the lung is involved, cavity-formation is less marked than with tuberculosis and abscess-formation is frequent. There is a tendency to spread by contiguity, with disregard of anatomical boundaries almost suggestive of neoplasm. The lesion spreads through the diaphragm, and in 80 per cent of cases shows a persistent draining sinus of the anterior chest-wall. Also, chest pain is a very constant symptom. More than half the cases show skin lesions. Proof of aetiology is furnished by microscopic examination of the pinhead, yellow sulphur granules in sputum or pus. A gram-stain will demonstrate a tangled mass of blue threads, surrounded by red clubbed ends. With streptothrix, a Ziehl-Neelsen stain reveals a loose network of filaments of variable acid-fastness, sometimes granular. The yeast-like group includes organisms reproducing by means of thallospores, such as blastomycosis, torula, monilia, oidium and oöspora, and those reproducing by means of

ascospores, such as saccharomyces, endomyces, Willia and coccidioides. Blastomycosis is a disease primarily affecting young adults subject to exposure or engaged in manual labor. Symptoms are loss of weight, cough, purulent (often bloody) sputum, and chest pain, dating from an upper respiratory infection. There are irregular fever, chills and sweats. Skin involvement is present in 95 per cent of cases, varying from small pustules to large abscesses, which form chronic granulomata. Bone and joint destruction occurs in over two-thirds of the cases, and over one-third may show renal involvement. Addition of 10 per cent sodium hydroxide to the pus or sputum will demonstrate yeast-like budding forms 10 to 30 micra in diameter, with doubly refractile contours. Coccidioidal granuloma, which gives an almost identical picture, occurs primarily on the eastern seaboard. The skin lesions tend more toward ulceration, and lymphatic involvement is more marked. Cummins considers suppurative orchitis a diagnostic lesion. Moniliasis is not yet generally accepted as a cause of primary pulmonary disease. It is not uncommon as a condition secondary to tuberculosis. In pure moniliasis the base of the lung is especially involved, the apices clear. Diagnosis rests on the demonstration of the monilia and their pathogenicity and repeated absence of tubercle bacilli from the sputum. In the third group are aspergillus, penicillium, mucor, rhizomucor, acremoniella, sporotrichium and alcadium. There are usually probably secondary invaders. Both careful clinical and also bacteriological (or mycological) studies are required to distinguish these infections from one another and from tuberculosis.—*Mycotic Infection of the Lungs in the Differential Diagnosis of Pulmonary Tuberculosis, H. J. Bakst, Meeting Mass. Med. Soc., June 5, 1935, reported in New England J. M., December 12, 1935, ccxiii, 1172.*—(*A. P.*)

Differential Diagnosis of Pulmonary Tuberculosis and Pulmonary Circulatory Changes.—A case is cited of a patient admitted to the Heathfield Sanatorium, Scotland, presented by Grant and Miller of Ayr. A coal-miner, a man of 25, showed advanced cardiovascular lesions at necropsy, with generalized oedema, double hydrothorax, pericardial effusion, chronic venous congestion of lungs and liver, and myocardial infarction. Except for the patient's age, the clinical picture of pulmonary oedema secondary to left ventricular failure is quite common, often associated with blood spitting. *Points of differentiation: 1:* History of severe and prolonged substernal pain, usually necessitating morphine, with or without typical angina. *2:* Enlargement of the heart, always present after coronary thrombosis and before failure. *3:* Abnormal electrocardiogram pointing to recent coronary thrombosis. *4:* X-ray evidence of engorgement of vessels at the hilum and often also extending radially outward. *5:* Preponderance of râles at the lung bases, or sometimes asthmatic wheezing with squeaks and groans—cardiac asthma. Pulmonary vascular congestion from left ventricular failure most often complicates essential hypertension, and there will often be a history of high blood-pressure over a considerable period; of dyspnoea on effort for at least several weeks; and of cardiac asthma, especially at night. Various findings indicative of left ventricular weakness are common gallop rhythm, accentuated pulmonic second sound, alternating pulse. Mitral- or aortic-valve disease may be factors. Aortic aneurysm is easily missed without an X-ray. Wassermann and Hinton reactions are usually positive. Congenital septal defects give rise, when patent, to massive hilar shadows. Pulmonary thrombosis or embolism with infarction, usually an acute surgical or postoperative complication, may cause confusion with tuberculosis because of sudden chest pain and either haemoptysis or pleural exudate. There is more evidence of shock, and usually of secondary right ventricular dilatation if the obstruction is extensive. Rarely its development is insidious. Pulmonary endarteritis obliterans also causes dilatation of pulmonary vessels and right heart, often with cyanosis but never haemoptysis. A careful study should suffice to distinguish these conditions.—*The Differential Diagnosis of Pulmonary Tuberculosis and Pulmonary Circulatory Changes, P. D. White, Meeting Mass. Med. Soc., June 5, 1935, reported in New England J. M., December 12, 1935, ccxiii, 1179.*—(*A. P.*)

Encapsulated Interlobar Effusion.—Interlobar effusions follow effusions into the peripheral pleural cavity and become encapsulated by the formation of adhesions. Early or small effusions may often be demonstrated with the patient in the lateral decubitus position when not seen in the upright position, since in the latter position the fluid accumulates largely below the dome of the diaphragm. Even a small amount of fluid in the pleural cavity is a predisposing factor in the formation of encapsulated interlobar effusions.—*A Roentgen Study of the Mode of Development of Encapsulated Interlobar Effusions, L. G. Rigler, J. Thorac. Surg., February, 1936, v, 295.*—(*L. F. B.*)

Interpretation of X-Ray Films of Chest.—In chest work the roentgenologist should have the status of a consultant, and should therefore take into consideration clinical and laboratory findings when he expresses an opinion. Without these, he may find a cavity or exudate, without being able to determine its aetiology. Even miliary tuberculosis must not be diagnosed from the X-ray alone, since the appearance in pneumonoconiosis is very similar. It is true that the productive type of adult tuberculosis can usually be diagnosed easily from the films alone. This is the "fan-type," open where there has been a recent lobular pneumonia, closed where scar-tissue has formed and contracted. The presence of several of these fans of different densities is almost diagnostic, probably 99 per cent so with good films. Stereoscopic films are most valuable, but a single perfect film is preferable to a slightly imperfect stereoscopic pair. Too vivid an imagination may lead to errors in interpretation. As to localization of lesions, stereoscopic films are quite important. So-called "subclavicular tuberculosis" is usually actually posteriorly located, along the posterior subapical bronchus. The taking of vast numbers of chest films on inferior media (paper films) and their rapid-fire interpretation without adequate study and control is condemned. Tuberculin tests and films should not be turned out faster than trained workers can investigate the homes for sources of infection. An unprejudiced group of statisticians should carefully go over the results of mass studies and make deductions. There are many epidemiological questions unanswered. X-ray studies are likely to be more helpful on adults than children; certainly definite significant lesions are more readily determined in adults. In children, caseocalcareous lymph nodes and apical fan lesions are of serious significance. In children under twelve, one such density is sufficient to indicate prolonged care and attention. Any pulmonary exudate demonstrable in the film of a child should be considered serious until proved otherwise. Many such clear promptly, but when due to tuberculosis some fine calcific deposits or strands usually persist. Few "benign pulmonary exudates" are really due to tuberculosis. Anyone who thinks he can make the differentiation solely by X-ray deceives himself. The misconceptions expressed under the name of "annular shadows," "peribronchial" and "peritruncal" tuberculosis have almost disappeared. Annular shadows have become either real cavities or localized areas of emphysema, while the truncal shadows have usually no relation to tuberculosis. —*The Clinical Value of the Chest Radiogram, K. Dunham, Tubercle, American Section, October, 1935, xvii, 33.*—(*A. P.*)

X-ray Appearance of Lobes of Lung and Interlobar Fissures.—Stereoscopic films are often taken to show the third dimension, but posteroanterior and lateral projections will be found valuable in studying the parts under consideration. Knowing the exact shape and position of a lesion is very important when it occurs in the chest. This is especially true of processes in the interlobar fissures, which may be confused with diffuse parenchymal involvement in the posteroanterior view but, when seen in a lateral projection, give an entirely different conception of the lesion. Since it is important that the roentgenologist be able to be specific regarding the location and nature of a lesion, exact knowledge of the appearance of the lobes of the lung and interlobar septa is of value. This study was therefore undertaken to provide a set of diagrams that would be a satisfactory guide as to the exact appearance of the divisions and interlobar septa of the lung. While a disease process will not involve all of a division of the lung and there may be distortion due to previous conditions, the general configuration of the part affected closely follows the diagrams experimentally obtained, and the latter have been found to be of great help in interpreting obscure shadows. Numerous diagrams and X-rays of clinical cases illustrating the diagrams are presented. Attention is called to the fact that the division of the lower lobes into superior and inferior divisions has an embryological basis, that the upper portion, situated more posteriorly, may have a shadow continuous with that of the liver in the posterior-anterior projection if the diaphragm is high, and that lung abscesses, pneumonia, and primary carcinoma are more frequently found in this part of the lung. Atelectasis is more frequently found in the inferior division, the shadow of this portion is continuous with that of the liver, and physical signs of disease may be few or masked by an emphysematous condition of the superior portion of the lobe. The left lung does not present as many confusing factors in its appearance as does the right. Pneumonia is relatively infrequent in the entire left upper lobe and interlobar effusions are not common. However, the lower lobe is as frequently involved in a pneumonic process as is the right lower lobe. It is also pointed out that interlobar effusions frequently have no physical signs due to surrounding lung parenchyma. Since interlobar effusions often follow pneumonia, it is imperative that they be correctly identified and not interpreted as lung abscess; lateral

views will show the true nature of the shadow. Effusions between the right middle and lower lobes are the ones most commonly diagnosed incorrectly. An atelectatic middle lobe may become decreased in size, so that it resembles a large interlobar effusion between these lobes. A high diaphragm superimposed over the cardiac shadow may give the appearance of an effusion between the lower and middle lobes and a pendulous breast in the lateral view may also simulate such an effusion. An effusion along the upper surface of the lower lobe could be mistaken for a large tumor in the posteroanterior view.—*A Study of the Roentgenologic Appearance of the Lobes of the Lung and the Interlobar Fissures, J. Levitin & H. Brunn, Radiol., December, 1936, xxv, 651.*—(*G. F. M.*)

Annular Shadows.—When pulmonary infiltrations resorb, and when this resorption develops centrifugally, annular shadows may be produced which closely simulate true cavities roentgenologically. This occurrence is rare, but it is important to consider this condition in a certain group of patients.—*Resorptions—Ringschatten (Resorptions-pseudokavernen), L. Vadja, Beitr. Klin. Tuberk., May, 1936, lxxxviii, 74.*—(*M. P.*)

Rib Defects Simulating Cavitation.—Rib defects, developmental and pathological, may give the appearance of pulmonary cavitation. Jones has observed 14 patients whose roentgenograms showed changes in the ribs which could easily be mistaken for cavity if a pathological process was present in the underlying lung. Nine cases showed dense circular shadows with rarefied centres due to infection or cystic change, four had congenital malformations of the ribs, and one had a deformity following rib-resection. Knowledge of the presence of a cavity is of real clinical importance, for it may be the deciding factor in making a diagnosis or determining the treatment needed. When there is any doubt, films more heavily exposed and taken at varying angles or stereoscopic films should aid in determining the true nature of the shadow.—*Rib Defects Simulating Pulmonary Cavitation, C. Jones, Radiol., November, 1935, xxv, 533.*—(*G. F. M.*)

Bronchoscopy in Diagnosis of Pulmonary Disease.—In the case of pulmonary tuberculosis and abscess, a careful history and examination, together with X-ray and laboratory aids, are frequently sufficient to establish the diagnosis. In the case of bronchiectasis, bronchography must be added, and demonstration is best done bronchoscopically, as it is often necessary to remove pus, granulation tissue and debris before instillation of lipiodol in order to obtain a completely satisfactory picture. Also, the bronchi should be inspected for stenosis, tumors and foreign bodies and in some cases to obtain a specimen for examination. *Case reports: 1:* A man of 49 had cough, little sputum repeatedly negative for tubercle bacilli, and progressive loss of weight and strength. On diagnostic bronchoscopy tubercle bacilli were found on direct smears of aspirated pus. *2:* A female admitted to Rutland State Sanatorium showed evidence of both tuberculosis and bronchiectasis, with sepsis due to blocking of bronchial drainage. *3:* A child of seven, with no cough, whose mother had died of pulmonary tuberculosis, was referred for diagnostic bronchoscopy because of poor general condition and peculiar X-ray shadow. Bronchoscopic examination suggested lung abscess, but guinea-pig inoculation of the pus was positive for tuberculosis. *4:* A young woman of 22, with an acute febrile onset, with desquamating rash, presented typical symptoms of hyperthyroidism but also a picture in which there was a question of tuberculosis or lung abscess. The presence of abscess in the right upper lobe was proved bronchoscopically. *5:* A young man of 21, an invalid for five years, with repeated haemoptysis and nothing definite in the X-ray film, showed advanced bronchiectasis on bronchoscopy.—*Bronchoscopy and the Differential Diagnosis of Tuberculosis, Lung Abscess and Bronchiectasis, G. A. Rice, Meeting Mass. Med. Soc., June 5, 1935, reported in New England J. M., December 12, 1935, ccxiii, 1173.*—(*A. P.*)

Ziehl-Neelsen versus Spengler Stains.—A comparison of the techniques for staining tubercle bacilli by the methods of Ziehl-Neelsen and Spengler was made. About 70 pairs of approximately uniform slides were made from positive sputum, largely in Gaffky-I and -II groups and with only a few in group III. The results showed a slight but fairly constant superiority of the Spengler method over Ziehl-Neelsen's. The superiority seemed to lie in the fact that the acid-fast organisms are easier to locate with Spengler's method. However, no slides negative by Ziehl-Neelsen staining were found positive by the Spengler technique. Furthermore, occassionally the tubercle bacilli were decolorized by the somewhat more complex staining method of Spengler, which sometimes fails to show the acid-fast bacilli.—*A Comparison of the Ziehl-Neelsen and Spengler Technics of Staining the Tubercle Bacillus, H. Wald & Charlotte C. Van*

Winkle, J. Lab. & Clin. Med., May, 1936, xxi, 844.—(M. T. W.)

Negative Sputum.—The unqualified term "negative sputum" has as little meaning as "normal renal" or "normal cardiac function" without stating by what observations or tests normality was assumed to exist. Since, of newly admitted patients, about 95 per cent of all positive sputa are found on direct smears, this study represents a select group, in that in each case no tubercle bacilli were found on repeated direct smears. The material was collected during the past eight years from 3 different institutions. Of 239 sputum specimens, from approximately 200 individual patients, 9.6 per cent were positive on concentration, 56.5 per cent positive on culture, 77.4 per cent positive on guinea-pig inoculation, and 100 per cent positive by any method. Similar findings were previously reported for 92 patients whose sputum had been negative on direct smear for at least two months. This report is not an evaluation of collapse therapy in terms of positive or negative sputum nor a criticism against collapse therapy, but is presented to point out the necessity of qualifying the term "negative sputum" by stating explicitly the methods used in the search for tubercle bacilli. We are unable to answer the question as to whether, for practical purposes, there is a significant difference between a patient whose sputum is really negative and one who expectorates so few bacilli that only guinea-pig inoculation will demonstrate them. So long as it happens in a certain percentage of unqualifiedly negative-sputum cases that, years after well being, unexpected breakdowns and fresh infiltrations occur, so long may one suspect that those occur more frequently in patients who continue to expectorate a few bacilli.—*Negative Sputum, M. Pinner & M. T. Woolley, J. Thorac. Surg., June, 1936, v, 476.—(J. F. B.)*

Tubercle Bacilli in Gastric and Duodenal Contents.—The standard methods for the examination of sputum of adult tuberculosis patients consist in staining direct smears and culturing the sputum on favorable media. When no sputum is available, emphasis is laid on studying laryngeal smears. The fractioned lavage of the gastric, duodenal, and gall-bladder contents can be helpful. Culturing of the gastric and duodenal contents gives much better results than can be obtained from the examination of direct smears. Laryngeal smears from 120 cases of adult tuberculosis were studied by both methods and the results were negative in eighty-four, while, in 17 of these 84 cases, the examination of the gastric contents gave positive results. This implies a high degree of reliability for lavage. But investigation of the stomach contents alone is not satisfactory because the duodenal contents showed the presence of tubercle bacilli more frequently. The bile gave positive results in only a few cases. There is no evidence that there is an appreciable excretion of tubercle bacilli in the bile as a result of an as yet unproved continuous bacillaemia. The examination of the gastroduodenal contents is of great help in demonstrating the presence of tubercle bacilli.—*Zum Nachweis der Tuberkelbazillen beim Erwachsenen; die Kultur aus dem Magen- und Duodenalinhalt, K. Menzel & J. Schramek, Beitr. Klin. Tuberk., July 27, 1935, lxxxvi, 371.—(F. G. K.)*

Laryngeal Mirror Test in Diagnosis of Pulmonary Tuberculosis.—The laryngeal mirror test, originally suggested by Sir James Duncan Grant, is the most accurate method of demonstrating both tubercle bacilli and their source of origin, yet is seldom known or employed. *Method:* The patient sits as for indirect laryngoscopy. The tongue is extruded and held by the physician while a laryngeal mirror is held horizontally over the glottis. The patient is then instructed to cough, and flecks of expectoration can be seen to shoot from the larynx on to the mirror. It is withdrawn along the roof of the mouth and the mirrored surface smeared over a slide. It is often possible to clinch a doubtful diagnosis at once. Tubercle bacilli can be demonstrated, even though no sputum is available. It may obviate the need for other more laborious and unpleasant examinations. It excludes the possibility of malingering (by substituting another sputum). In doubtful cases it may lead to earlier institution of collapse therapy.—*A Note on the Laryngeal Mirror Test for the Detection of Tubercle Bacilli, W. B. Wood, Tubercle, January, 1936, xvii, 162.—(A. P.)*

Demonstration of Tubercle Bacilli in Blood.—Since some tubercle bacilli remain in the plasma after the blood has been centrifugated, the author studied the effectiveness of concentration methods. Preliminary studies of human blood inoculated with small amounts of tubercle bacilli indicated that the sedimented erythrocytes contained fewer tubercle bacilli than did the whole blood. When the citrated, sedimented erythrocytes of a tuberculous guinea pig were treated according to the method of Loewenstein by haemolysis with distilled water but 16 colonies were obtained, while from the erythrocytes adsorbed on animal

charcoal 80 colonies were noted. When the whole blood from this animal was treated with saponin and then adsorbed on charcoal 130 colonies were noted. From the blood of a tuberculous patient, a growth of tubercle bacilli was obtained by the adsorption of the whole blood while the culture remained sterile when the Loewenstein method was employed. The addition of antiformin to the whole blood treated with charcoal reduced the number of colonies. Growth of tubercle bacilli was not inhibited by the presence of one per cent sodium citrate.—*Zur Frage des Tuberkelbazillennachweises im Blut, N. Kovacs, Zentralbl. Bakt., January, 1936, cxxxv, 509.*—(*J. D. A.*)

Loewenstein Technique for Isolating Tubercle Bacilli from Blood.—In 1932 Jensen obtained positive cultures of tubercle bacilli from 5 out of 18 blood-samples supplied in Loewenstein's laboratory. In Copenhagen he obtained negative results with 222 blood samples using the same technique and media. Of 101 of these blood samples examined concurrently at the *Staatliches Institut für experimentelle Therapie*, Frankfort-on-Main, only one showed a microculture. It could not be subcultured, and also failed to produce tuberculosis in the guinea pig. Of 186 of these same blood samples examined in Loewenstein's laboratory 14 yielded macrocultures and 9 microcultures, of which two could not be subcultured. At the *Statens Serum Institut*, Copenhagen, 479 cultivations from blood have been made during the last three years by Loewenstein's technique and in not a single case was there demonstrated a macroculture or a microculture, or acid-fast saprophytes. Seventy-five blood specimens, mostly from patients with very advanced tuberculosis, were inoculated into guinea pigs and only in one case did tuberculosis develop. Loewenstein, on the other hand, found 16 positive results from 149 Danish blood samples, namely, 2 microcultures, which he was unable to subculture, 7 microcultures which he could subculture, and 7 macrocultures. Fourteen of these cultures were studied by Jensen with the following results: Tubercle bacilli could not be demonstrated in four instances either by microscopy or by culture. The remaining 10 cultures were typed and compared with cultures isolated from the focal lesions of the same patients. In 4 cases, the cultures differed so widely that it was impossible to believe that they could have originated from the same patient. In 3 other cases, the disagreement was such as to make this doubtful. Concordance was established in 3 cases.—*Report on Investigations Regarding the Loewenstein Technique of Cultivating Tubercle Bacilli from Blood, K. A. Jensen, Acta Tuberc. Scandinav., Fasc. 4, December, 1935, ix, 253.*—(*F. B. S.*)

Tuberculous Bacillaemia.—Specimens of human blood and blood from animals inoculated intravenously or subcutaneously with tubercle bacilli, were taken in Cambridge, England, and duplicate portions were sent to Loewenstein in Vienna. In both places these specimens were studied for the presence of tubercle bacilli and every strain of acid-fast bacilli obtained in either place was typed in Cambridge. A comparison of the results follows: Experiments with 29 specimens were negative in both places. With 6 specimens of animal blood, positive results were obtained at Cambridge and negative results in Vienna. The cultures recovered from the animals at Cambridge were identical with those injected. With 16 specimens (3 human and 13 animal), the results were positive in Vienna and negative at Cambridge. Of the 13 cultures from animals, 10 were typed at Cambridge and each proved to be different in character from that injected. With 6 specimens (of animal blood) positive results were obtained both at Cambridge and Vienna. In two instances, both in animals injected with *BCG*, the findings were in agreement, *BCG* being recovered at both places. In 3 instances the results were discordant. The three strains recovered from the specimens at Cambridge were identical with those inoculated. The three strains from Vienna were different in type from those injected, namely, two human strains from a goat injected with *BCG*, and one avian strain from a goat injected with bovine bacilli. In the remaining instance no comparison could be made, as the Vienna culture was not sent to Cambridge.—*Tuberculous Bacillaemia, A. S. Griffith, Acta Tuberc. Scandinav., Fasc. 4, December, 1935, ix, 229.*—(*F. B. S.*)

Tubercle Bacilli from Blood of Cadavers.—Blood cultures, taken during life from 300 patients with tuberculosis yielded tubercle bacilli in only four instances. Of 41 cases of localized tuberculosis, 26 yielded positive blood cultures postmortem. Of 5 fatal cases of rapidly advancing tuberculosis, in which the cause of death was other than tuberculosis, none yielded positive blood cultures. Of 14 cases of generalized tuberculosis, mainly in children, 10 yielded positive blood cultures postmortem and 4 yielded negative cultures. Of 26 cases of generalized tuberculosis in adults 16 yielded positive blood cultures. In other words, 70 per cent of cultures of blood from patients who died with generalized or miliary tuber-

culosis, and whose death was caused by the tuberculosis, yielded tubercle bacilli. As it is unlikely that a slow-growing organism like the tubercle bacillus would increase rapidly in numbers in the blood-stream between the time of death and the time the cultures were taken, there must have been a terminal tubercle bacillaemia, which might very well have been the cause of death in these cases. Cultures made from blood taken from the right heart, the left heart, and the femoral vein all yielded about the same number of positive results. This indicates that tubercle bacilli are not in any great numbers picked up by the thoracic duct and dumped into the venous system. Cultures of the spleen yielded a higher percentage of positive results than those of any other organ or of the blood itself. The tonsil yielded a very high percentage of positive cultures likewise, but that organ is so subject to contamination by sputum that positive results from it are not valid evidence of bacillaemia. The spleens were carefully studied histologically for tuberculous granulation tissue and other signs of tuberculous foci. The authors were thus reasonably certain that cultures of this organ were essentially those of its blood content. In contrast to the results obtained from the spleen, a blood-poor organ like the postmortem heart yielded an extremely low percentage of positive results. The blood cultures were made on a modified Loewenstein medium. Organ cultures were made on congo-red, and malachite-green media.—*Zur Tuberkelbacillenkultur aus Blut, H. Popper, A. J. Leser & L. Gerzner, Virchow's Arch., June 18, 1936, ccxcvii, 368.*—(*C. L. D.*)

Importance of Serological Diagnosis.—The Meinicke, and Haag and Niggemeyer tests were run simultaneously on the sera of 1967 patients. Of these, 92.2 per cent were negative, and 7.8 per cent (167 cases) suspicious or positive. In 68 of the 167 cases, the diagnosis of tuberculosis had been made previously; in 33 cases, tuberculosis, as indicated by the positive tests, could be ascertained subsequently by the findings of positive clinical signs; while in 66 cases clinical examination failed to reveal any evidence of tuberculosis. Both tests are very valuable and should be used to supplement each other. In a number of cases of clinical tuberculosis the tests were negative; these were found to be those made in stages of active improvement or rapid failure. In a state of decreased vitality there is temporary reduction of the immune response. Negative tests were also obtained in cases of localized pleural or joint involvement, suggesting a lack of stimulation of the blood-serum in generalized disease. The results on the sera of syphilitic patients and on sera showing a tendency to moderate haemolysis were contradictory.—*Die Bedeutung der serologischen Untersuchung auf Tuberkulose, Friedrich E. Haag & E. L. Schiedges, Klin. Wchnschr., February 8, 1936, xv, 195.*—(*F. G. K.*)

Complement Fixation with S and R Antigens.—In 347 cases of pulmonary tuberculosis in various stages, the serum was examined by a quantitative procedure first used on immunized rabbits. The S and R antigens, prepared from different forms of tubercle bacilli, were made from water extracts of S and R bacilli according to Wadsworth's method. They were standardized by titration with the serum of rabbits immunized with S and R organisms. The amount of complement fixed by the same amount, 0.02 cc. of each patient's serum, with both the S and R antigens was determined. The tests were repeated on three or four successive days to obtain the probable error. The unit of comparison was that suggested by Wadsworth, Maltaner and Maltaner, the amount of complement reacting with sensitized antigen and red cells to yield haemolysis of 50 per cent of the cells. The specific fixation with each antigen was determined, and the average amount fixed by the same antigen in the presence of five normal human sera. An S/R antibody index was obtained by dividing the amount of complement fixed specifically by the R antigen, at the point of 50 per cent haemolysis, in the presence of equal amounts of the same human serum. Cases were grouped both clinically and serologically and compared. Graphic charts show the comparative relations in each group. *Summary: 1:* One hundred and forty-four cases of pulmonary tuberculosis clinically favorable gave an S/R antibody index of 1.27, 0.15. One hundred and eighty-six clinically unfavorable gave an index of 1.65, 0.25. *2:* When the cases were classified into high, low and intermediate index groups, the high, over 1.75, were all unfavorable cases; the low, under 1.25, two-thirds favorable; and the intermediate, half favorable and half the reverse. *3:* When cases showed clinical improvement, the S/R antibody index was usually found to decrease; when less favorable, there was generally an increase. *4:* Examination before death always gave a very low S/R index. *5:* These findings may result from S infection in acute cases and R infection in chronic and healing cases. The more probable explanation is related to the rate of response of the body to S specific and species specific antigens in the infecting tubercle bacilli.—*Complement-*

Fixation in Pulmonary Tuberculosis with "S" and "R" Antigens, G. B. Reed, C. E. Rice, J. H. Orr & B. G. Gardiner, Tubercle, American Section, December, 1935, xvii, 114.—(A. P.)

Reliability of Pirquet Test.—Out of 931 patients, over 30 years of age, given Pirquet tests, only 2.9 per cent gave negative reactions. Patients (530) who were negative to the Pirquet test were retested by means of the cutaneous reaction of Hamburger-Mantoux, using 1 cc. of 1:1000 dilution of O. T. (or 1 mgm.), and only 17 reacted positively. Therefore, the general criticism of the Pirquet method is unjustified. When two different Old Tuberculins (one the international standard and the other a preparation made in Denmark) were compared the latter proved to be considerably stronger than the former.—*Die Pirquetsche Tuberkulinreaktion: Ihre Zuverlässigkeit, J. Heimbeck, Acta Tuberc. Scandinav., Fasc. 4, December, 1935, ix, 381.—(F. B. S.)*

Tuberculosis of Eye.—In general, tuberculosis rarely affects the eyes, if we except interstitial optic neuritis or papilloedema accompanying meningitis. The order of frequency of involvement is (1) iris and ciliary body and (2) choroid and retina. Choroiditis may be patchy, solitary tubercle, and miliary tubercle. Affections of the conjunctiva and cornea are rare and closely allied to tuberculous skin diseases, such as lupus. Ulcerations are usually confined to the tarsal conjunctiva, but may spread inward toward the lachrymal sac and down the nasal duct; the opposite mode of progression, however, is far more common. Tuberculous conjunctivitis has become rarer with the lessened frequency of moistening with spittle children's eyelids when stuck together and of using professional "lickers" in iron and steel works where conjunctival and corneal lacerations occur. Phlyctenular conjunctivitis occurs mostly in young children in depressed general health. The lesions are usually situated at the limbus (corneosclerotic margin), are not characteristic of tuberculous lesions, and clear up too rapidly under simple remedies. However, they are indicative of tuberculous infection somewhere in the body. Tuberculous iritis is the most frequent of true tuberculous ocular lesions. The ciliary body is involved early, and the appearance of grayish or yellow-gray nodules, either at the pupillary margin or between the cornea and anterior chamber, confirms the diagnosis. The nodules of syphilitic iritis are larger and yellow. Operative interference with such nodules is inadvisable, as it disperses the bacilli. One must keep in mind the existence of iritis due to other types of chronic infection. Tuberculous affections inside the eye are always secondary to disease elsewhere and affect mainly the vascular coat, the choroid. Solitary tubercles may occur anywhere,—the disc margin or macula or in between. The multiple miliary type of tuberculous choroidoretinitis is rare. The patchy type of lesion must be distinguished from syphilis, which gives a more punched-out appearance. In atrophic choroidoretinitis there is either a patchy massive pigmentation or a heaping-up around a white atrophic area. Vision is reduced and the macula destroyed. There have been 9 such cases among 752 blind, deterioration of vision usually being rapid and early, often with no other history of illness. This condition is assumed to be due to "obsolescent tubercle." Treatment of most of ocular tuberculosis should be along conservative and constitutional lines.—*Tuberculosis of the Eye, R. E. Bickerton, Tubercle, February, 1936, xvii, 193.—(A. P.)*

Massive Tuberculosis of Tonsils with Pulmonary Tuberculosis.—An English girl of 21, came to Switzerland from Hong Kong, where she had lived all her life, with pulmonary tuberculosis of the left apex. She had had two severe attacks of bronchitis, following the second of which there was persistent cough, sputum, failure to regain weight and appetite, and persistent slight evening elevation of temperature. A roentgenographic film, taken two months after the second attack, showed left infraclavicular infiltration, and the patient had two attacks of pleuritic pain on this side. On reaching Switzerland there were signs of a severe diffuse bronchitis, and X-ray films revealed spread of the process throughout the left lung. There were night-sweats, and the sedimentation rate was increased. The sputum showed numerous tubercle bacilli. Left artificial pneumothorax was induced, followed by rapid improvement, although ease of fatigue and high sedimentation rate persisted. About this time swelling of the lymph nodes behind the angle of the jaw was noted, the tonsils appearing normal. Three weeks later there was sore throat, high intermittent temperature, and enlarged and inflamed tonsils, together with a severe laryngitis, the appearance of which suggested tuberculosis but the process subsided rather rapidly except for the glands, which increased. After another two months the tonsils were enucleated under local anaesthesia and pathological examination showed a severe tuberculous process with caseous foci. Improvement was marked, the lymph nodes disappeared within a week, and the

sedimentation rate became normal. The tonsillar lesion may have been the primary one.—*A Case of Massive Tuberculosis of the Tonsils, B. Hudson & F. L. Wollaston, Tubercle, October, 1935, xvii, 30.*—(*A. P.*)

Cervical Adenopathy in Pulmonary Tuberculosis.—In 14 cases of pulmonary tuberculosis with calcified cervical lymph nodes, those with unilateral pulmonary involvement were observed to have the cervical involvement on the homolateral side. In those cases with bilateral pulmonary involvement the cervical adenopathy was on the side of the oldest pulmonary lesions. In one case there was bilateral cervical adenopathy in the presence of bilateral pulmonary disease. In six of these, there had been a haematogenous spread, as evidenced by miliary lesions in the lungs (2 cases), or a history suggestive of generalized haematogenous infection in the past. In only one case was there roentgenographic evidence of anastomosis of the cervical and mediastinal lymphatics.—*Adénopathies cervicales et tuberculose pulmonaire, E. Berthet & G. Scorpati, Arch. Med. Chir. l'App. Resp., 1936, xi, 97.*—(*C. L. D.*)

Laryngeal Tuberculosis.—This is, with rare exceptions, a complication of pulmonary tuberculosis. The author estimates a total of over 110,000 persons requiring relief from this complication in England. It is by far the most common specific disease of the larynx, far exceeding cancer. The longer a pulmonary lesion remains unhealed the greater the incidence of laryngeal disease: 5 per cent in early pulmonary cases, 31.5 per cent in stage-3 cases, and 50 to 83 per cent of those coming to necropsy. It is also, next to meningitis, the most serious complication of pulmonary tuberculosis. Of all cases seen by Thomson at Midhurst, England, between 1911 and 1921, no less than 70.5 per cent were dead before 1924. Among the symptoms, voice failure and hoarseness are most common; next, discomfort and dysphagia. But often there are no localizing symptoms (about 12 per cent of cases), hence, the importance of routine laryngeal examination on sanatorium patients. The most usual location for lesions is the endolarynx, and especially the interarytenoid space. When the endolarynx is not involved, the arytenoids are most frequently invaded. In 477 cases, the interarytenoid area showed involvement in 231, the arytenoids in 117, the vocal processes in 132. In treatment the galvanocautery is used only after a preliminary course of silence or whispering, and then only in selected cases. In 74 in which it was used. cure resulted in 62 per cent. Altogether, silence resulted in 34 per cent cures, whispering in only 15 per cent, the galvanocautery in 62 per cent of a selected group. There is a total of 25 per cent cured, and 29.4 per cent improved. These three measures were the only ones found effective. Diathermy has no advantages over the galvanocautery and is more traumatizing. Chaulmoogra oil is of doubtful value. Tracheotomy is very rarely indicated. Most beneficial of all is proper and adequate treatment of the pulmonary disease, especially by collapse therapy. General artificial sunlight is disappointing, and concentrated local radiation even more so because of its technical difficulties and the discomfort and fatigue to the patient. In the early stages of pulmonary tuberculosis, most cases of laryngeal involvement will recover under vocal rest, sometimes supported by the galvanocautery, if the pulmonary disease is properly handled and responds. Severe advanced cases should become increasingly uncommon.—*Tuberculosis of the Air Passages, St. C. Thomson, Tubercle, January, 1936, xvii, 145.*—(*A. P.*)

Electrical Anaesthesia in Tuberculous Laryngitis.—Methods now in use, especially to relieve painful dysphagia, consist of (1) application of local anaesthetics in the area of upper-laryngeal-nerve distribution; (2) laryngeal operations; (3) neurolytic injections of 90 per cent alcohol; and (4) heliotherapy, radiotherapy and diathermy. Their results are unequal and not altogether satisfactory for clinical requirements, being neither reliable nor constant. Some methods even caused increased pain. Hoffmann's method, published in 1908, of superior laryngeal nerve injection with 90 per cent alcohol is generally preferred to other methods of inducing anaesthesia and relieving painful dysphagia, yet even its results are not uniform. *Application of electrical anaesthesia:* This is a "medical", in contradistinction to a "surgical," anaesthesia, which consists in eliminating in a localized territory the pain due to evolutive or "avoluted" lesions. It has no appreciable or durable effect on truncal algias but a very remarkable and constant one on peripheral algias. It is obtained by iodide ionization of the larynx encircled by special electrodes. The ionization current is produced by a galvanic apparatus with a fine reducing coil working on 45-volt dry batteries or on accumulators capable of giving at least 15 milliamperes. The electrodes are of unoxidizable steel with a thickness of 0.5 mm. The anterior one is 75 mm. long and 35 mm. wide, and the posterior 100 mm. long and 35 mm. wide. They are very

light, and distributed uniformly on the surface by proper bandaging. The active area is formed by several layers of absorbent cotton, at least 1 cm. thick when wet and extending at least 1 cm. over the edges of the metallic electrode. The anterior electrode is soaked in a 2 per cent solution of potassium iodide linked with the negative pole, and the posterior one in pure water linked with the positive pole. The anterior is placed in front of the larynx, the posterior on the nape of the neck, and they are kept in position by a special thick rubber isolating collar. The current is of 10 to 12 milliamperes' intensity, and the usual duration of sitting half an hour. Sittings are repeated daily until the duration of anaesthesia obtained is twenty-four hours; after this only when pain reappears. *Subjective effects:* As soon as the current passes, the patient notices a sensation of stricture in the neck and a taste like that of ink or copper, accompanied by slight salivation. The sense of stricture disappears in a few minutes. Five or six minutes after passage of the maximum current there is marked diminution of pain on swallowing, reduced to a slight disagreeable prickling, and auricular radiations decrease and disappear. After ten or fifteen minutes, anaesthesia is total and absolute. Any kind of food can now be taken without discomfort or a sensation of more than slight hindrance to swallowing. *Characteristics of electrical anaesthesia: 1: Rapidity of effect:* Under similar conditions it appears in from five to ten minutes of application of maximum current (10 to 12 milliamperes) and is complete in ten or fifteen minutes. *2: Completeness of anaesthesia:* It is total in the disappearance of every painful sensation. *3: Trueness or constancy:* It always appears in a given length of time, uninfluenced by repetition. The time of appearance of anaesthesia varies with each patient, but is always the same for a given patient. *4: Progressiveness:* After each successive treatment the duration of anaesthesia increases progressively. The initial anaesthesia lasts a half to an hour and a half at most, but after the sixth or eighth treatment it reaches twenty-four hours. The sole remaining symptom is a stiffness like the feeling of having a cardboard larynx. The increase in duration of anaesthesia occurs by geometrical progression and doubles in value from one sitting to the next. *5: Stability:* Anaesthesia electrically evolved is not influenced by either the temperature or general state or evolution of the lesions. Therefore it is a symptomatic treatment. It has a further advantage in not suppressing tactile sensibility and therefore not subjecting the patient to the dangers of aspirating food and drink.—*Electrical Anaesthesia: Simple Curative and Symptomatic Treatment of Painful Dysphagia in Tuberculous Laryngitis, R. Grain, Tubercle, March, 1936, xvii, 261.*—(*A. P.*)

Light Treatment of Tuberculous Laryngitis.—With a Kromayer lamp and suitable applicators, efficient local irradiation is practicable. The pharynx and larynx are properly anaesthetized locally. The laryngeal reflex must be abolished and the epiglottis rendered insensitive, the patient coöperating intelligently by traction on the tongue with the right hand. Then a small mirror, postnasal size, is introduced, while the glass rod or applicator is carefully passed forward over the tongue and the epiglottis hooked forward by its tip. The rays are directed on to that portion of the larynx requiring the maximum concentration, an attendant controlling the time of exposure with a stop watch. The initial exposure is a half-minute; then this is gradually increased to five minutes. Weekly exposures suffice for patients who must travel far. Lamps supplied by direct current are vastly superior to those designed for alternating current. Relief from pain is usual, either due to induced hyperaemia or direct sedative effects. Penetration of the rays occurs only to 0.1 mm. depth. Light treatment is best withheld, according to Wessely, until the pulmonary condition is under control and the patient afebrile. The hypertrophic type of tuberculous larynx responds best; next the ulcerative, and lastly the oedematous.—*Light Treatment in Tuberculosis, T. G. Millar, Brit. M. J., December 28, 1935, no. 3912, 1254.*—(*A. P.*)

Tuberculous Tracheobronchitis.—A case of unilateral pulmonary tuberculosis treated successfully by thoracoplasty was seen a year after discharge complaining of intermittent attacks of severe dyspnoea. Sputum examinations were positive at this time for tubercle bacilli. Bronchoscopy was considered but not carried out. Autopsy showed stenosis of the trachea as due to tuberculous tracheobronchitis extending from the bifurcation to the thyroid cartilage. The authors conclude that all patients with satisfactory collapse of the lung, who have a positive sputum, should be bronchoscoped.—*Tuberculous Tracheobronchitis, P. D. Crimm & J. W. Strayer, J. Thorac. Surg., April, 1936, v, 441.*—(*L. F. B.*)

Treatment of Tuberculous Empyema.—*Methods and Principles:* The procedures available include both minor and major interventions. Among the former are (1)

aspiration, with or without air replacement and/or irrigation; and (2) oleothorax. Major procedures include (1) intercostal drainage, open or closed; (2) thoracotomy and drainage open or closed; (3) phrenic avulsion, alone or supplementary to thoracoplasty, pneumothorax or oleothorax; (4) thoracoplasty partial or complete; (5) rib resection and excision of granulation tissue and thickened pleura forming the outer cavity wall, or the fashioning of a hinged flap to be brought into close contact with the visceral pleura. Particular principles, in addition to constitutional treatment, include (1) avoidance of secondary infection or, if it occurs, prompt and adequate treatment; (2) relief of symptoms, especially those due to mechanical causes, such as large collection of fluid or valvular pneumothorax. Also, if the underlying lung is presumably healthy its reëxpansion is aimed at, while if diseased, especially with cavitation, both the pulmonary lesion and the empyema must be treated and the aim is to keep the lung collapsed. *Selection of Procedures:* This depends on (1) the condition of the lungs; (2) presence or absence of pyogenic infection; (3) presence or absence of bronchial or external fistula; (4) age and general condition of patient; (5) presence of tuberculosis elsewhere; (6) severity of infection and response to preliminary treatment; (7) duration of the empyema. The cases are classified into 4 main groups as follows: *1: No signs of pulmonary tuberculosis and no pyogenic infection. 2: Pulmonary tuberculosis present but no pyogenic infection. 3: Pyogenic infection present but no signs of pulmonary tuberculosis. 4: Pulmonary tuberculosis and pyogenic infection present.* Groups 2 and 4 will be considerably larger than 1 and 3. When there is doubt as to pyogenic infection, repeated smears and cultures are necessary. As a rule, absence of pyogenic infection should be assumed until demonstrated. The absolute diagnosis of tuberculous empyema depends on the finding of the tubercle bacillus on smears or animal inoculation. Less certain criteria are the microscopic appearance of a piece of the pleura or the wall of a sinus or visualization of tubercles with the thoracoscope, or a predominance of lymphocytes in the fluid. Finally, a tuberculous empyema often begins as a serous effusion. It may occur as a complication of (1) artificial pneumothorax, (2) spontaneous pneumothorax, (3) pulmonary tuberculosis, (4) rupture or puncture of a subpleural focus or rupture or division of pleural adhesions, (5) independently, which is least common. *Treatment of group 1:* The object is to free the pleural cavity from pus and secure its obliteration with pulmonary expansion. Aspiration alone may suffice, but must usually be supplemented by air replacement in decreasing amounts, allowing gradual expansion of the lung. Should this not occur or fluid persistently reform, a complete thoracoplasty is required, in stages. *Treatment of group 2:* The aim is to cure the empyema and also keep up collapse of the diseased lung. Sufficient amounts of air are introduced to keep the lung down. If it, nevertheless, tends to reëxpand, oleothorax should be tried; if this fails, thorocoplasty and phrenic avulsion. If the general condition contraindicates this, intercostal drainage and lavage may tide the patient over. *Treatment of group 3:* If the patient's condition is good and the infection mild, aspiration, air replacement and irrigation may lead to cure. If not, closed intercostal drainage plus irrigation should be done in the absence of bronchial fistula. The results of oleothorax are uncertain. Rarely a bronchial fistula closes, with reëxpansion of the lung, but most of these patients need a thoracoplasty and fistula is no contraindication but the reverse. At first, however, the severity of the infection must be reduced. *Treatment of group 4:* These patients have the poorest prognosis and those who survive nearly always come to a thoracoplasty. This should be done as soon as the secondary infection is controlled, unless the patient is too ill, when permanent drainage and irrigation must be kept up. *Pleural lavage*: This can be done through one needle only if the cavity is small. Usually two needles are necessary, and, after aspiration, the cavity is filled with irrigating fluid from below upward and repeated until the return is clear. Among fluids recommended are (1) Dakin's solution, useful with a thick and severely infected pleura; (2) physiological salt solution, used when the pleura is thin and especially if there is bronchial fistula; (3) dyes, such as 0.1 per cent gentian-violet, 0.2 per cent methylene-blue, or 2 per cent cresyl-violet. A small amount of a stronger concentration may be left in the pleura but not repeatedly. *Oleothorax:* Its indications are reviewed: 5 per cent gomenol in olive oil, with a test dose of 5 cc. is used. It may aggravate the pulmonary or pleural lesions, however, or cause a fistula in the case of a stiff walled empyema. *Intercostal drainage:* Its main use is to get the patient into better condition for more radical treatment. It is usually best avoided in the absence of secondary infection. *Results of treatment:* The mortality is from 30 to 50 per cent, the chief causes of death being secondary infection and pulmonary tuberculosis.—*The Treatment of Tuberculous Empyema, M. P. 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man, Brit. M. J., October 12, 1935, no. 3901, 659.—(A. P.)

Intestinal Tuberculosis.—This term here includes a variety of pathological and clinical states in this series of cases found in a survey of 8,087 routine postmortems over twenty-five years at the Royal Chest and St. Bartholomew's Hospital. Among these, pulmonary tuberculosis was found in 785 (9.8 per cent) and intestinal tuberculosis in 233 (2.7 per cent). Nearly all cases of intestinal tuberculosis showed coexisting pulmonary tuberculosis, and intestinal tuberculosis was present in 29 per cent of cases of pulmonary tuberculosis. *Age incidence:* Its peak occurred in early childhood, when miliary tuberculosis is most frequent; and a later, less pronounced peak corresponded with the known incidence of the more acute forms of pulmonary tuberculosis. *Classification and forms:* The terms "primary" and "secondary" are abandoned as involving too many assumptions and of no clinical importance. A morphological classification is preferred, the two main divisions being into nodular (28) and ulcerative (181), then adhesive (12) and lymphatic (8). Of the ulcerative cases, 133 were associated with active pulmonary tuberculosis, 38 (of whom two-thirds were children) with miliary tuberculosis, and 15 apparently primary. In the vast majority, approximately 90 per cent, there was a definite group of lesions which merge imperceptibly from the earliest miliary tubercle to the established tuberculous ulcer. The term *lymphatic* designates those cases in which the actual intestinal wall is not primarily affected but has become involved in a mass of caseous lymph nodes. This may result in either obstruction, perforation or abscess formation. The adhesive type is uncommon, and nearly always affects adults. The peritoneal surface becomes involved from infected lymph nodes or surrounding structures, especially the Fallopian tubes. Among all cases of intestinal tuberculosis the local lymph nodes were involved in 108 (46.4 per cent). Gross peritoneal lesions were present in 69 (about 30 per cent), and the great omentum was infiltrated in 33 (14.3 per cent). Considering the upper respiratory tract, tracheal ulceration was found in 22 cases (9.6 per cent) and laryngeal ulceration in 19 per cent. Renal tuberculosis was found in 39 cases (16.8 per cent). *Complications:* Most frequent were perforation, faecal abscess-formation and intestinal obstruction. The first occurred in 17 cases (7.3 per cent). The most common site of rupture was the ileum (11). Intestinal obstruction, due to dense adhesions occurred in 7 cases. *Aetiology and pathology:* Direct infection of the intestinal tract by ingestion in a healthy animal has been found difficult, although a positive result is much more likely if the animal is in poor condition, and especially if there has been imbalance in the intake of vitamines A, C and D, as well as calcium deficiency. Parenteral introduction of tubercle bacilli has been more successful than the direct method in producing intestinal lesions, although neither series of experiments is convincing. However, the common association between active ulcerative pulmonary and intestinal lesions indicates inadequate resistance to infection. In the vast majority, there is opportunity for direct-contact infection by means of bacillary sputum. In the cases associated with miliary tuberculosis, on the other hand, active pulmonary lesions are rarely found and the infection may be assumed to be haematogenous. In the direct-contact group, the initial lesions are lymphatic, followed by caseation and, later, ulceration. The regional lymph nodes are commonly involved except when the ulceration is confined to the colon. It is difficult to explain why blood-stream infection should select the ileum and caecum. *Symptomatology and diagnosis:* There may be little or no abdominal discomfort in advanced disease and, conversely, intestinal symptoms may exist without demonstrable lesions. Most suggestive are slight discomfort after meals, occasional diarrhoea and constipation, or unexplained nervousness and loss of weight. Pain, when present, is apt to be most marked late in the day and after eating. A tendency to remission is characteristic. Nausea and vomiting are other important symptoms; also epigastric pain; but they are not common. An elevated temperature complicating apparently quiescent pulmonary tuberculosis is suggestive. In rare cases there is a typhoidal picture. Physical examination is usually negative beyond localized tenderness where the peritoneum is involved and lumps where there are hypertrophic or glandular masses. The faeces may be watery and peculiarly foetid, sometimes with an excess of fat. The presence of tubercle bacilli is not significant except when there is no evidence of pulmonary disease. Blood examinations are of little value, although there is usually a moderate leucocytosis and sometimes severe secondary anaemia. Endoscopic examination of the bowel may be conclusive when the lower part is involved. X-ray examination following a barium meal done at intervals up to twelve hours shows localized areas of spasm near ulcerated areas with a spastic filling-defect where the colon is involved. Adhesions produce permanent alterations in

outline. Active ulceration of the small intestine produces intestinal hurry, but in the atonic type there is retardation. When the caecum is involved, a barium enema may demonstrate constant spasm ("intolerant caecum"), which is fairly characteristic. *Treatment:* The first point is prophylaxis, avoiding the swallowing of infected sputum. A hydrochloric-acid mixture with meals and full doses of the chief vitamines are desirable. A low-residue nonirritating diet should be arranged, adding codliver-oil and orange or tomato juice. Heliotherapy seems the most promising therapeutic measure. In a few cases abdominal exploration is advisable, with a view to surgery (excision or short-circuit). Recently published results afford encouragement in treating this complication. —*Intestinal Tuberculosis, J. Maxwell, Tubercle, May, 1936, xvii, 337.*—(*A. P.*)

Primary Tuberculous Infection of Intestine.—It is now generally agreed that the bovine tubercle bacillus is virulent for man and that clinical tuberculosis may follow a primary infection of the intestinal tract (ingestion form of primary infection). The exact percentage of primary infection by this route is still a matter of dispute. A boy, 8 years old, dying of miliary tuberculosis, showed a lesion in the ileum which fulfilled the requirements of a primary infection. A table listing a carefully selected number of reports on the location of the primary focus (tuberculosis) brings out that the percentage of primary intestinal infections is much higher in the British Isles than in any other of the countries from which investigations have been reported. The three publications from England give 34.2 per cent as primary abdominal infections, whereas the average of the German investigations is 5.3 per cent and that of the Austrian 3.9 per cent. From Hong Kong, China, a percentage of 10.6 is reported; Opie in St. Louis found no primary abdominal infections; Wollstein and Spence in New York City found 4.3 per cent. It is probable that most primary intestinal infections are caused by the bovine bacillus. However, this organism is not confined to the ingestional route, for it has been found in the sputum or lungs of 6 persons, who, according to Lange, were directly infected through contact with tuberculous cows. Griffith and Munro have isolated the bovine organism in 49 cases of pulmonary "phthisis." Nevertheless, the association of primary intestinal disease and bovine infection is a close one. According to Park and Krumwiede the relation of human to bovine infections among adults is 62.6 to 1; among children from 5 to 16 years of age, 2.8 to 1, and among children below 5 years of age, 3.8 to 1. Griffith has shown that in Scotland 33.2 per cent of the autopsies on children below 14 years of age revealed bovine bacilli, whereas in persons above 15 years the percentage was 17.6. One may therefore conclude that outside of England and Scotland primary tuberculous infection of the intestine is unusual except in areas of uncontrolled dairy products.—*Primary Tuberculous Infection of the Intestine, H. S. Reichle, Arch. Path., January, 1936, xxi, 79.*—(*J. S. W.*)

Ileocaecal Tuberculosis.—A case of tuberculous ileocaecal tumor is described in some detail, both clinically and pathologically. The outstanding feature was the unusually large number of tubercle bacilli that were present in the lesion, which showed an incomplete granulomatous tissue. The tubercle bacilli were identified as bovine tubercle bacilli. Four other cases of tuberculosis of the ileocaecal region with tumor-like development are described. It is concluded that the origin of these lesions is in the appendix and that the constant dissemination of the tubercle bacilli from the appendiceal lesion causes the tumor-like ileocaecal tuberculosis.—*Beitrag zur Frage des tuberkulösen Ileocecaltumors, W. Cossmann, Beitr. Klin. Tuberk., May, 1936, lxxxviii, 1.*—(*M. P.*)

Sea Bathing and Surgical Tuberculosis.—While the value of properly planned sun bathing in the treatment of surgical tuberculosis is now universally recognized and applied, comparatively little attention has been paid to sea bathing, yet it deserves consideration. *Historical:* Richard Russel, called "Sea-water Russel", was born in 1687 and died in 1759. He wrote two books on sea bathing and sea-water drinking in connection with various diseases especially lymphatic and bone-and-joint tuberculosis, and scrofula, and practised at Brighthelmstone, now Brighton, becoming famous at sixty-three. Sea bathing then became fashionable and popular. The value of the summer holiday was appreciated before George II and only became popular after George III made Weymouth "Royal." Lettson, impressed by Russel's work, founded the Sea Bathing Infirmary, now the Royal Sea Bathing Hospital, at Margate. From the start, it had an open-air solarium. In France, following the Napoleonic wars, the Government heard of the success of a fishwife at Berck-sur-Mer, near Boulogne, who exposed tuberculous children to sun, air and sea-water on the beach. A large municipal hospital was then erected, followed

by other institutions. *The Marine Hospital and the Crippled Tuberculous:* It is well established that during a long and trying illness climatic change with altered environment may be advantageous. This is especially true of hospitalized children and, to meet this need, a marine branch of the Cripples' Hospital, at Alton, England, was established at Hayling Island. There is an advantage in continuity of management and control. The site should be carefully selected, with a view to (1) mild and equable climate; (2) sunlight of high actinic value; (3) absence of mists and fogs; (4) absence of water or atmosphere pollution. The closest available proximity to the sea is best, remote from towns. The littoral should be flat, not steep and rocky. There should be wide excursions of tide, to ensure cleansing, and the prevailing winds should blow across the moist sands, charged with stimulating and tonic substances, yet the hospital should not be exposed to gales. The marine hospital at Hayling Island faces southeast, so that there are never strong winds and heavy seas, and sand is not blown about. The advantage of the early morning sun is had, and the rainfall is the lowest on the South Coast of England. North are the South Downs, which afford protection from cold winds. Rain-clouds are attracted to the hills of the Isle of Wight and deflected, and the rainfall is actually nearly 50 per cent greater ten miles to the north. The site was chosen after careful exploration of the whole South of England coast from the Thames to the Severn. Patients are conveyed between the two institutions (Alton and Hayling) by motor ambulance. Nurses serve three to six months, and many bathe all the year round. Patients are examined weekly by Gauvain himself. They are carefully selected, as marasmic and cachectic children rarely do well, nor do very many under the age of five. There must be power to respond to stimulation without exhaustion. Suitable cases are children of good constitution, whatever the local lesion. Those who sunburn readily and have good digestion respond better than others. *Physical and physiological effects:* Hill and Argyll Campbell have demonstrated a rise in basal metabolism, which after two or three months ranges 40 per cent above average. This is due chiefly to exposure to cold air, but chilliness and shivering are to be avoided. There should be a feeling of well-being and exhilaration. Spraying, paddling or immersion in sea-water is, beyond a certain point, preferable to cold air. The patient can actually enjoy the effects of skillful massage without exertion and movement. Atrophied muscles fill out readily. *Technique:* The selected children are first acclimatized and then gradually exposed to the sun and sea-breezes. They are then allowed to paddle for short but increasing periods in the sea, avoiding fatigue. Later the body is sprayed with sea-water, and finally total immersion is allowed. The patients bathe within a net pegged to the sands. Those unable to walk are carried on netting stretchers laced to iron frames and dipped. Paddling or spraying is usually not allowed until the water temperature reaches 58°F., nor total immersion until 60°F. The optimum is 65 to 68°. When lower, the seawater may be heated, but not above 70°. The rising is preferable to the falling tide, and the best time is two to three hours after breakfast. The temperature of the water is a little higher on the rising tide in winter, a little lower in summer. After the bath the child is placed in a pen with a warm planked floor and wattle hurdle around it. In the centre is a large brazier, with a bright coke fire, and along one side a wooden trough of warm water. The child is wrapped in a warm towel and dried before the brazier, and then sits with feet in the trough and is given a warm drink. The children often laugh, link arms and dance. Later, after a short rest, they play on the beach in the sunlight until dinner, after which they rest again. Gauvain prefers the cold fresh English seas to the enervating Mediterranean.—*Sea Bathing in the Treatment of Surgical Tuberculosis, H. Gauvain, British M. J., December 7, 1935, no. 3909, 1987.—(A. P.)*

Treatment of Bone and Joint Tuberculosis.—A tuberculous bone or joint lesion is an osteitis or arthritis occurring in a tuberculous patient and secondary to some primary focus. Children often get infected *via* the tonsils or septic teeth, with involvement of regional lymph nodes. But in most cases the primary focus is undiscovered, and the osteitis or arthritis occurs after a latent period. Because the disease is not primarily local, operation does not cure the patient. Treatment should be both general and local. Radical treatment of the local lesion is now less commonly indicated. Even where it is, it is wise to immobilize the infected limb for approximately three months under good conditions before operating. In certain cases, operative fixation or immobilization is the method of choice, but treatment is still conservative. The indications for surgical fixation have been disputed. *Pott's disease:* In advancing progressive spinal caries in children, Gauvain thinks that mechanical immobilization yields better results than operative interference, almost invari-

ably resulting in cure with little or no deformity and with reduced risk of general dissemination or meningitis. Bone-grafting, as advocated by Albee, is indicated *after* successful treatment if there is poor dorsal musculature or unsatisfactory conditions for after-care, to avert future deformity. In border-line cases, deformity may be avoided by instruction in back-raising exercises, with or without a pull-splint during arrest of the caries. Absolute immobility during the later stages of recumbent treatment is neither necessary nor desirable. In the case of adults, it has been argued that osteosynthesis shortens treatment and expedites return to work. Gauvain, however, believes that it often results in insufficient treatment, with poor results, and that it should only be done when the disease is stationary or quiescent, its value being to prevent deformity or increase of deformity and shorten the period of wearing a brace or jacket. It is disheartening to see cases subjected to osteosynthesis later drifting into sanatoria because of abscess-formation or other complications. Operation should be more carefully restricted, and, if performed early, strict recumbency should still be insisted on. *Hip disease:* In most cases, if adequate conservative treatment and after-care are given, operations are not called for. When the disease is completely arrested, deformity can be corrected and the patient allowed up, with crutches and a perfectly fitting celluloid splint, usually worn at least two years. If there is a tendency to adduction deformity the hip should be arthrodesed; if it cannot be corrected, bifurcation or osteotomy, with perhaps arthrodesis, should be done. *Tuberculosis of the knee:* In children operation is never indicated; in adults excision is to be preferred. *General considerations:* Climatic considerations play some part, producing stimuli which are an effective aid. Sunbaths and light are especially valuable in cases of multiple lesions in small children. Sea-bathing is also valuable in certain cases. Open-air treatment is generally advised, but many hospital wards are miserable and cheerless. Gauvain's hospital wards have folding walls along the entire length of the southern side and can be closed without obstructing ventilation. There is panel-heating in the floor and a coal fire at each end. Gauvain also favors sliding roofs. King George's Sanatorium, at Bramshot, and the latest hospital in Holland are so designed.—*Treatment of Bone and Joint Tuberculosis, H. Gauvain, Tubercle, May, 1936, xvii, 360.—(A. P.)*

Frozen-Section Diagnosis of Tuberculous Joints.—To determine the accuracy of frozen sections of fresh tissue, a study was made of 175 exploratory operations done during the years 1928 to 1934. The preoperation diagnosis was correct in 74 per cent of the cases. The frozen-section diagnosis agreed with the paraffin-section diagnosis in 84 per cent of the cases and guinea-pig inoculation corroborated the diagnosis in 84 per cent of the cases. Of 23 cases proved tuberculous by paraffin section, but not by frozen section, 20 had a preoperative diagnosis of tuberculosis. Twelve were confirmed by guinea-pig inoculation. The remaining 3 cases were considered nontuberculous before operation, but were proved to be tuberculous by paraffin section and guinea-pig inoculation. Of 5 cases called tuberculous by frozen section but not confirmed by paraffin section or guinea-pig inoculation, there was little doubt that the frozen-section diagnosis was wrong. From this it is clear that, unless the frozen sections demonstrate unmistakeable tuberculosis, it should not be reported as such. Of 32 cases thought to be tuberculous before operation, but proved not to be, frozen-section diagnosis was correct in 84 per cent. Of 13 cases considered nontuberculous before operation, but later proved tuberculous, the frozen-section diagnosis was correct in 69 per cent. One hundred and sixteen cases had a final diagnosis of tuberculosis, and the frozen-section diagnosis was correct in 77.5 per cent. Fifty-nine had a final diagnosis other than tuberculosis, and the frozen-section diagnosis was correct in 91.5 per cent. Frozen-section diagnosis agreed with the final diagnosis, in the 175 cases, in 82 per cent. Success of frozen-section diagnosis depends on proper selection of tissue, with regard to gross appearance of disease and fibrous-tissue replacement, satisfactory technique in preparing the sections, and correct interpretation of the slides. Duration of the disease, and not location, seemed to affect the accuracy of diagnosis. No tissue should be called tuberculous when there is any ground for reasonable doubt.—*Frozen-Section Diagnosis of Tuberculous Joints, W. E. Swift, J. Bone & Jt. Surg., July, 1936, xviii, 641.—(L. F. B.)*

After-Care of Orthopaedic Tuberculosis.—There has been developed a very comprehensive system by the London County Council in connection with their cases of surgical tuberculosis. At present, 95 per cent of cases of tuberculosis of bones and joints discharged to London from Princess Mary's Hospital, Margate, are supervised as to after-care from the central hospital. This after-care clinic is held at the County Hall, weekly with one of the hospi-

tal staff, usually the Medical Superintendent, in attendance. The chief organizations participating are the Central Tuberculosis Department at the County Hall, the Borough Tuberculosis Department, the Invalid Children's Aid Association, and the Central Hospital. Summaries of the records of the patients to be examined are conveyed between hospital and clinic at each session, and parents told to forward apparatus needing repair or renewal. When necessary, arrangements are made for preliminary X-rays to be taken in London and forwarded for comparison. A copy of observations and recommendations is in turn sent weekly to the Central Office at the County Hall to be forwarded to the Borough Tuberculosis Officer. The Invalid Children's Aid Association, in return for a grant by the Council, undertakes to convey information regarding nonmedical details, admissions and discharges, and the tracing of cases. Most children attending the clinic go to a Physically Defective School, and the interest of the school-nurse and teachers must be secured. The London County Council has appointed a consulting orthopaedic surgeon, who periodically examines the pupils and reports on them. They are also seen periodically by the Borough Tuberculosis Officer, who is in possession of the surgeon's latest note and properly confines his own advice to matter of general welfare. In the care of patients discharged to convalescent homes or other institutions, a summary of the case-notes is sent to the County Hall for dispatch to the home and a close liaison has been worked out with the Shaftesbury Society, whose homes at Bournemouth, Hastings, Hayes and Margate are used for the crippled children of London. Cases returning to the London area from the hospital attend the clinic, and are seen as frequently as their condition demands, usually once a month for the first six months for spine, hip, knee and ankle, then every two or three months until the time arrives to begin to release from splints, when they are seen more frequently and the apparatus very gradually discarded, beginning with two or three hours in the evening after school, then six to eight hours during school, then all day except during the night. The whole trial period consumes from four to eight months. No case is released from observation until quiescent for three or four years, and, in the case of spine or lower extremity, five to seven years. *Results:* There has been a definite reduction in the number of gross deformities needing correction. Many of the readmitted cases were for observation only. This is a vast improvement over conditions ten years ago. *Vocational training:* Because of crippling and disability, a large proportion of patients can never compete in the labor market with healthy persons. Therefore a suitable trade or vocation is essential in order to provide an earning capacity and conditions which prevent relapse. Boys are sent to Burrow Hill Colony, Frimley, Surrey, and girls to a Workers' Home at Denmark Hill. A large percentage of cases discharged are in constant employment and the scheme is economically sound. Also, at the Physically Defective Schools in London, technical or trade instruction is given older children and efforts made to place them in employment.—*The After-Care of the Tuberculous in London, J. G. Johnstone, Tubercle, April, 1936, xvii, 297.*—(*A. P.*)

Osteosynthesis in Pott's Disease.—The evolution of Pott's disease lasts a little more than 3 years. During this period the patient is immobilized upon a plaster bed, and no operative attack is made upon the disease. Some months before the patient would be allowed to walk again, according to the conservative procedure, a bone-graft is applied. Two short grafts not extending beyond the diseased area are placed lateral to the spinous processes. For the lumbar region the grafts are rigid, while those used in the dorsal region are supple or semisupple. Short grafts do not fracture, undergo absorption, become decalcified, or lengthen, except at the level of the disease. Long grafts hinder the development of compensatory curves and changes in the healthy intervertebral discs. They may act as a rigid lever and increase a flexional strain.—*Osteosynthesis in Spinal Tuberculosis, J. Calve & M. Galland, J. Bone & Jt. Surg., January, 1936, xviii, 46.*—(*L. F. B.*)

Tuberculosis of Bones of Foot.—From 1920 to 1934, 147 cases were examined in the Peiping Union Medical College Hospital and active treatment was instituted in 129 of these. The diagnosis was confirmed in 124 cases by microscopic examination. The disease was slightly more prevalent in males than females, and between the ages of 10 and 40 years. More than half the cases among males occurred within the third decade, and within the second decade among females. Thirty-six per cent showed isolated lesions of a single bone and 64.0 per cent had multiple lesions of two or more bones. The bones involved, in order of frequency, were calcaneum, atragalus, first metatarsal, scaphoid, and first and second cuneiforms. Draining sinuses were present in 127 cases, the sinuses having usually developed during the first eight months after onset of the first symptoms. One or more

associated lesions of active tuberculosis were found in 65 per cent of the cases. Because of poor social or economic condition of the patient or the advanced stage of the local disease, all but five of the cases received surgical treatment. From a total of 83 cases over 16 years of age, good results, indicating local cure, were obtained in 54; fair results, meaning apparent or almost complete local cure, in 8 cases; poor results in 20 cases; and questionable results in one case. In the group of 46 cases between 1 and 16 years of age, results were good in 23, fair in 10, poor in 12, and questionable in one. Experience with curettage was extremely discouraging. Amputation through the leg is reserved for the most advanced cases, in which the disease is widespread in the tarsal or metatarsal bones and surrounding soft tissue. Isolated lesions of the toes are usually treated by amputation. Excision of the lesion with a margin of healthy tissue is indicated in any case where the disease is localized sufficiently so that a useful portion of the foot may remain.—*Prognosis and Treatment of Tuberculosis of the Bones of the Foot, L. J. Miltner & H. C. Fang, J. Bone & Jt. Surg., April, 1936, xviii, 287.*—(*L. F. B.*)

Key to Abstractors

A. P.: Andrew Peters, Springfield, Massachusetts.
C. L. D.: Charles L. Dunham, Chicago, Illinois.
F. B. S.: Florence B. Seibert, Philadelphia, Pennsylvania.
F. G. K.: F. G. Kautz, New York City.
G. F. M.: Gertrude F. Mitchell, Northville, Michigan.
J. D. A.: Joseph D. Aronson, Philadelphia, Pennsylvania.
J. F. B.: James F. Busby, Northville, Michigan.
J. S. W.: J. Stanley Woolley, Loomis, New York.
L. F. B.: Lauren F. Busby, Northville, Michigan.
M. B. L.: Max B. Lurie, Philadelphia, Pennsylvania.
M. P.: Max Pinner, Ithaca, New York.
M. T. W.: Mildred T. Woolley, Tucson, Arizona.